CHICKENS, CHICKENS, AND MORE CHICKENS

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The development of Chickens, Chickens, and More Chickens could not have taken place without the editorial assistance of Rich Reynnells, Ken Holleman and his student Carrie Brooks, H. Graham Purchase and Kris Park. Barb Smagner's typing and editorial services were also indispensable to this project.

Some of the text was modified from Extension publications produced at the USDA, the University of Minnesota, the Northeastern states, Mississippi State University, and Pennsylvania State University. Many other universities contributed by producing publications that informed the author about many aspects of backyard poultry husbandry. Kris Park originated the chapter on Poultry Enterprise which contributed greatly to the bulletin.

CHICKENS, CHICKENS, AND MORE CHICKENS

Poultry production on a small scale can be rewarding in many ways. Most people raise poultry primarily for pleasure or hobby. However, birds can be raised for exhibition and table fare as well. Whatever your reason, this bulletin describes how best to raise your poultry with a minimum of cost. Included in the contents are management tips ranging from artificial incubation to developing a poultry enterprise.

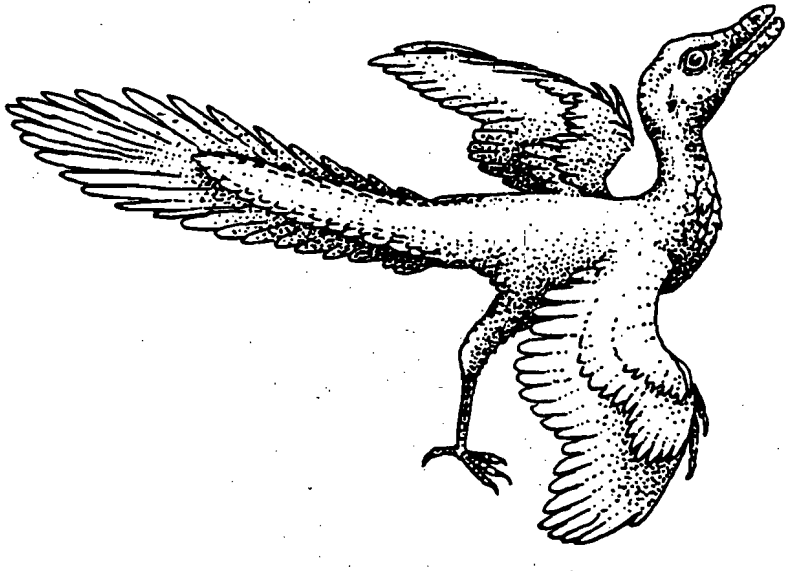
HISTORY

The earliest known bird, the Archaeopteryx ("ancient winged creature") appeared on earth about 150 million years ago. It spent much of its time on the ground but had the ability to climb trees. The scales on the shanks, along with similar skeletal and other anatomical and physiological features established this bird as a close relative to the reptile.

The true origin of the domestic chicken is still disputed. Many scientists feel that the Red Jungle Fowl or Gallus bankiva is the ancestor of today's chicken. Others feel that other bird species had to play a prominent role in the development of the very diverse breeds of chicken present today.

The first recorded domestication of the chicken occured in India in the year 3200 BC. Egyptians bred chickens in captivity, incubated eggs artificially and grew chicks for eggs or meat beginning in about 1400 BC. At the same time, domestication occured in China. Explorers aided in the dissemination of the fowl across many parts of Persia, Europe and the British Isles. By the year 1 AD, domesticated chickens were located in many parts of western Asia and eastern Europe. From these locations, they were spread to South Africa, Australia, Japan, Russia, Siberia, and Scandinavia. Chickens were brought to the Americas by the English in 1607 and became an important part of the first settlement.

Wild fowl still exist in the Middle-eastern jungles. Colorful offspring can even be found roaming through small villages in these countries.



Chapter 1

SELECTING THE RIGHT BIRD FOR YOU

Many factors must be considered when deciding what kind of poultry to raise. First, you must decide whether you want to raise birds for meat, eggs, hobby, or for a combination of these reasons. After making this decision, you must choose what class, breed, and variety best suits your fancy. Although chickens are not your only choice of birds, information about other poultry such as ducks, geese, guineas and pigeons can be found elsewhere.

Chickens are organized by class, breed, and variety. A class is a group of standard breeds that have been developed in specific locations of the world. The major classes are American, Asiatic, English, Mediterranean, and Continental. Breeds are distinguished within a class by differences in body shape, size, and skin color. Breeds are divided into varieties by differences in comb type, feather color and pattern. A strain is produced by inbreeding members of a specific variety or breed through at least five generations. The resulting offspring always look the same and can be identified as belonging to a certain strain.

Chickens generally can be classified according to their productive qualities. Chickens that lay large numbers of eggs are usually not meaty birds. Conversely, a bird well-suited for meat production lays fewer eggs per year. A third group is called dual purpose because the chickens lay a fair number of eggs but also maintain a relatively heavy body weight.

Some breeds are more ornamental than others and will cost more initially. Therefore, you should decide whether you want to raise birds for production purposes or for exhibition/hobby. Table 1 lists common chicken breeds according to their use, egg color and skin color.

Bantams are miniature chickens which originated in the Orient. Typically, they are identical versions of the larger chicken. However, there are some bantams which have characteristics not found in standard bred chickens. Bantams are generally raised as pets or sometimes as natural incubators due to their broodiness.

Table 1. Common Breeds of Chickens and Their Uses

Class	Breed	Usage	Egg Color	Skin Color
American	Plymouth Rocks	dual	brown	yellow
	Dominiques	dual	brown	yellow
	Wyandottes	dual	brown	yellow
	Javas	dual	brown	yellow
	Rhode Island Reds	dual	brown	yellow
	Rhode Island Whites	dual	brown	yellow
	Buckeyes	dual	brown	yellow
	Chanteclers	dual	brown	yellow
	Jersey Giants	dual	brown	yellow
	Lamonas	dual	white	yellow
	New Hampshires	dual	brown	yellow
	Hollands	dual	white	yellow
	Delawares	dual	brown	yellow
Asiatic	Brahmas	meat	brown	yellow
	Cochins	meat	brown	yellow
	Langshans	dual	brown	white
English	Dorkings	dual	white	white
	Redcaps	egg	white	white
	Cornish	meat	brown	yellow
	Orpingtons	dual	brown	white
	Sussex	dual	brown	white
	Australorps	dual	brown	dark
Mediterranean	Leghorns	egg	white	yellow
	Minorcas	egg	white	white
	Spanish	egg	white	white
	Andalusians	egg	white	white
	Anconas	egg	white	yellow
	Sicilian Buttercups	egg	white	yellow
	Catalanas	dual	white	white
Continental	Hamburgs	egg	white	white
	Campines	egg	white	white
	Polish	egg	white	-
	Houdans	dual	white	white
	Crevecoeurs	dual	white	white
	La Fleche	dual	white	white
	Faverolles	dual	brown	white

Chickens raised on commercial poultry farms are not pure strains. Geneticists have selected birds with the best performance and bred them with birds of specific characteristics to produce the super bird of today.

Commercial meat birds are a cross between Plymouth Rocks, Cornish, and other breeds. Their offspring are bred to produce the dominant white feathers preferred by processors and consumers.

For the backyard poultry producer, several words of advice can be given. The American and English class are excellent producers of meat and eggs. Others such as the Mediterranean and Hamburg class are splendid layers.

There are many sources of birds for your backyard. Local feed stores often sell chicks during the summer. Your county Cooperative Extension office may have a list of local poultry growers who sell birds. An organization exists that aims to preserve the older strains of production birds, which were used to develop commercial egg and meat birds of today. If you are interested in buying one of these strains contact: American Minor Breeds Conservancy, Box 477, Pittsboro, NC 27312.

To locate the type of chicken you have selected, consult a local agricultural magazine, feed store, or county Cooperative Extension Agent. In addition, the following list of literature will help you in your search:

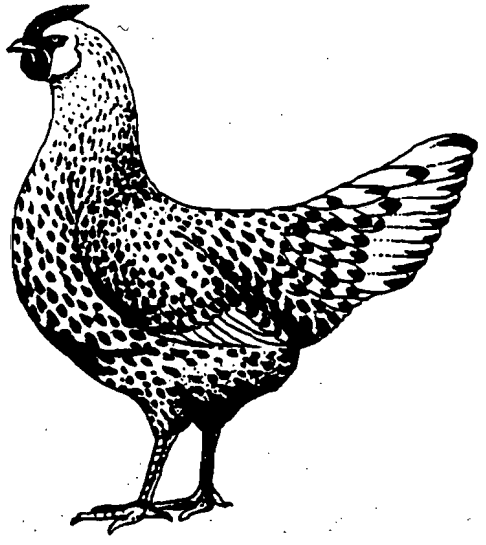
- Poultry Press - P.O. Box 542, Connersville, IN 47331

- American Poultry Association - 26363 S. Tucker Rd, Estacada, OR 97023

- Feather Fancier - RR5, Forest, Ontario, Canada NON1JO

- Who's Who in Poultry - Brazos Valley Poultry Club, P.O. Box 890, College Station, TX 77841

- National Poultry Improvement Plan - APHIS-VS, Room 828FB, Hyattsville, MD 20782



Chapter 2

EQUIPMENT

The use of proper equipment can be very important for a large chicken flock. Mechanical or semi-mechanical equipment can save hours of labor. Mechanical feeders, waterers, and pit cleaners are used for farm-sized flocks. Feed and litter carriers that operate on tracks are adapted for use in long houses. Bulk feed requires special storage bins. Backyard flock farmers can often improvise or build for their needs.

Select equipment that is safe for the birds, convenient, and easy to keep clean. Whenever possible, install equipment so that it can be easily removed when the house is cleaned.

Brooder House Equipment

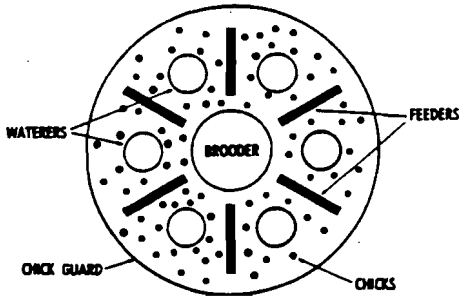
Brooders

To give day-old chicks a proper start, the brooder must provide a temperature of about 95°F in winter and 90°F the rest of the year.

Some types of brooders heat the entire room or house. Others warm the area under or near the hover, leaving the rest of the room relatively cool. Chicks feather better when they have a cool place to exercise and a heat source for warmth. NEVER chill the chicks.

Enough space under the brooder is important to keep chicks warm without crowding, piling up, or smothering. Usually, each replacement chick needs about 6 or 7 square inches of brooder space. Manufacturers often overrate the capacity of their

IDEAL BROODING TEMPERATURE AND EQUIPMENT ARRANGEMENT



BROODING UNITS

brooders under winter conditions. For example, a 96-inch hover rated as a 1,000-chick brooder will satisfactorily brood 600 replacement or 850 broiler chicks during the winter.

Brooder heat may be in the form of hot water or hot air. The fuel may be electricity, oil, gas, or coal. Electric and gas brooders require minimum care. When selecting brooders, consider the fuels available in your area and the amount of heat needed during the seasons in which you intend to brood. Choose brooders that can be raised and lowered easily, are easy to clean, have reliable thermostats, and are equipped with thermometers.

In cold weather, electric brooders should be used only in well-insulated houses. If a house is not insulated, these brooders may not give off enough heat during the winter to keep chicks warm and the litter dry. Auxiliary heat may be needed then.

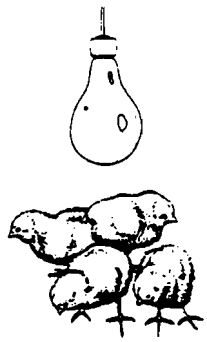
Gas and oil-burning brooders vary widely in heat output. In cold weather, wet litter may be a special problem with gas brooders that do not have flues for venting combustion gases to the outside.

Coal-burning brooders require more labor than other systems because they must be refueled and cleaned frequently. However, they keep the entire house warm and the litter relatively dry.

Since brooders supply heat, they can be a hazard in a poultry house. Fires often start from leaky oil brooders. Coal brooders can also be a problem if not properly operated. A fire-resistant material may be placed under brooders to minimize fire dangers.

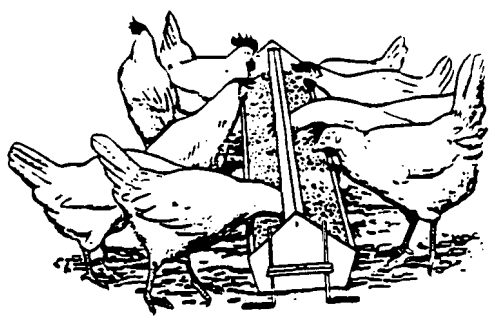
Lights

A 7 1/2- or 15-watt light under the hover will attract young chicks to heat. Attraction lights are discontinued usually after the first two weeks of brooding.



Feeders

Hanging tube feeders are rapidly replacing trough feeders because they require less labor and chicks aren't bruised as much. Allow at least three hanging feeders--each 15 inches in diameter with a 25-pound capacity--per 100 chicks.



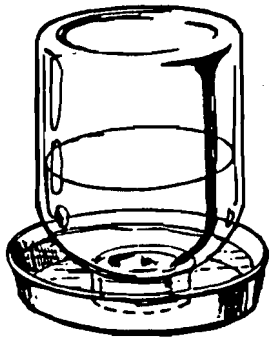
If available, trough feeders may be used for a farm flock. Allow at least two 4-foot trough feed hoppers, open on both sides, or 200 linear inches of hopper space for each 100 chicks at three weeks of age. Trough feeders must be large and low enough such that all birds can easily reach them. More feeder/waterer space than these minimum recommendations may be needed.

When chicks are seven weeks old, provide three 4-foot feed hoppers or 300 linear inches per 100 birds. Provide additional feeders when the temperature is above 80°F.

If mechanical feeders are used, carefully follow the manufacturer's directions.

Waterers

Use two 1-gallon water fountains for each 100 chicks during the first two weeks. Allow 40 linear inches of water trough per 100 birds at three weeks, and 50 linear inches from seven weeks until the end of brooding. Provide additional waterers when the temperature is above 80°F.



(Chick Waterer)

Other equipment

Roosts should be provided in the brooding house if roosts are to be used in the laying house (See Laying House Equipment).

Broiler House Equipment

Feeders, waterers, and electric lights are standard equipment for broiler houses.

Requirements for feeders and waterers are the same as those for brooding houses.

Range Equipment

On range, provide three 6-foot feeders open on both sides for each 100 birds, or 4 inches of feeder space per bird. To supply water on range, use one 8-gallon gravity-flow waterer, or eight linear feet of a trough waterer, or a fountain with an equivalent capacity for each 100 birds.

Feed hoppers and waterers for range should be close to the shelter. Range equipment should include a protective canopy or sunshade.

Many range shelters have no interior equipment. Some have one feed trough and one fountain inside the shelter for use in bad weather.

Roosts and nests should be installed in range shelters before pullets begin to lay. Place roosts at floor level.

Laying House Equipment

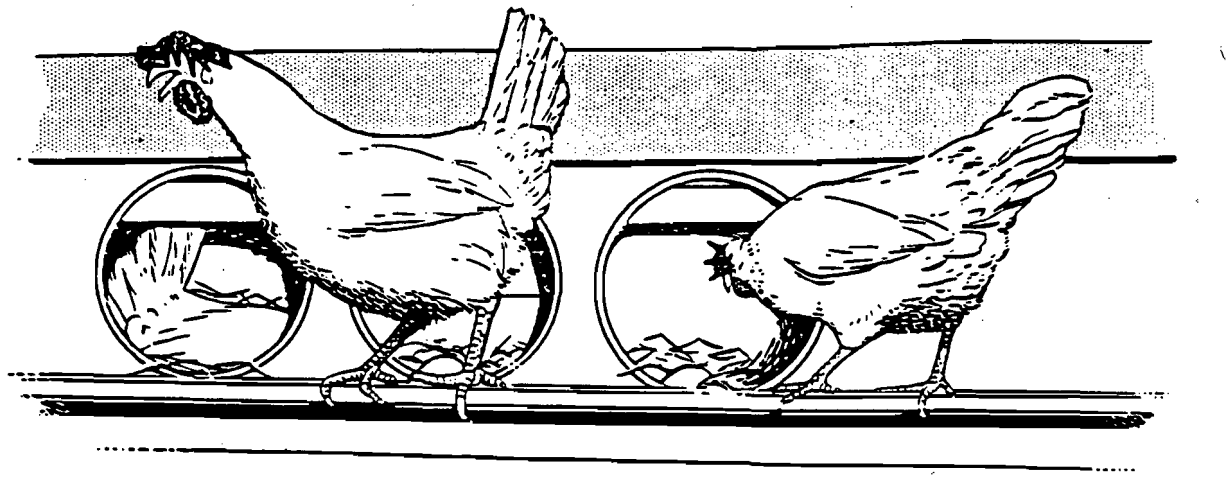
Nests

Well-designed nests can reduce the time needed to care for the laying flock and the eggs. Nests may be metal or wood; they may have roll-away floors with egg trays or other arrangements for convenient egg collection. The interiors should be dark.

Nests may be placed in the middle or along the walls inside the building. They may be arranged in a double deck.

Community nests accommodate several layers at one time. Allow one nest 2 feet wide by 14 feet long, with an entrance 8 inches square, for each 140 hens; or provide 1 square foot of nesting space for each 5 hens.

Individual nests are just large enough to hold one hen. In figuring flock needs, provide one individual nest for each four birds. Usually, an individual nest is 10-12 inches wide, 12-14 inches high and about 12 inches deep. A perch below the entrance will help keep the nest clean.

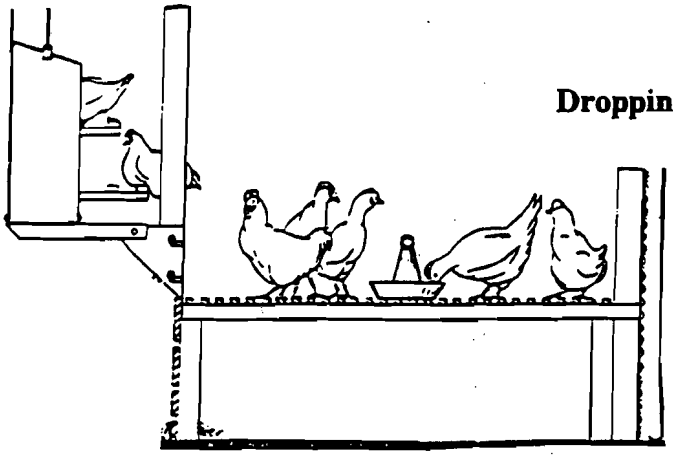


Roosts

Roosts should always be used for growing pullets that are later to be maintained as layers in houses with roosts.

Roosts should be made of 2-inch stock, with rounded or beveled upper edges. Leghorns and other small breeds require 8 linear inches of roost space per bird; large breeds require about 10 inches of space per bird. Place roosts 13- 15 inches apart. Normally, roosts are placed above dropping pits. Screen off the area under a dropping pit to keep the birds from biulding nests in it and from scavenging in the droppings and scattering them into the house area. Roosts may be built on a slant from the floor. The back of the roosts should be 24 inches from the floor with 1-inch mesh wire beneath them.

Multiple-deck roosts sometimes are built over dropping pits for flocks of more than 1,000 birds. Housing needs are reduced by 1/2 square foot of floor space per bird with multiple-deck roosts.



A dropping pit is designed to hold droppings for several months. Slats should be built over the pit for droppings to fall through as birds to walk across the top.

Dropping pits

Each panel should be made of 1" x 2" slats set vertically for maximum strength, with 1/2" openings between slats. A popular pit design leaves the middle third of the floor space covered in litter and the other two-thirds as slats on either side. For easy handling, the floor over the pit may be made into 6- by 6-foot panels. Pits are labor savers but they can harbor rats and flies.

In order to keep litter dry, feeders and waterers often are placed over pits. Be careful to keep birds out of the pits.

Feeders

Adequate feeder space is a must. At 15 inches in diameter with a 35 to 50-pound capacity, six hanging feeders per 100 medium-weight layers is recommended. If hanging feeders are not available, provide at least 40 feet of feeder space. Four 5-foot trough feeders with both sides open or the equivalent footage is adequate for each 100 laying hens.

Automatic feeders vary in capacity. Consult the manufacturer's literature or a specialist before installing such equipment.

All feeders should be placed within 10 feet of a waterer.

Waterers

For 200 laying pullets, 16 feet of watering space should be provided. An 8-foot automatic hanging waterer open on both sides will do the job. When temperatures go above 80°F, watering space should be increased by 25 percent.

By placing watering devices over dropping pits, the amount of wet litter can be minimized.

Water systems may be automatically controlled or they may flow continuously. Adequate drainage for continuous flow waterers should be provided to maintain good house conditions.

Water requirements vary with the type of waterer and the season. An automatic system uses 6-8 gallons of water daily for each 100 layers.

A reserve water supply is helpful during disease outbreaks or times of disaster. One or more clean oil drums can be used for water storage.

Lights

Before installing light fixtures, be sure that the electrical wiring is adequate and meets all safety and local code requirements. If you need assistance, contact your local power company.

Allow one ceiling light for each 200 square feet of floor space. Adjust lights to illuminate the entire floor and roosting areas. A clean 40-watt incandecent bulb or 7-watt fluorescent bulb provides adequate foot candles of light under this arrangement.

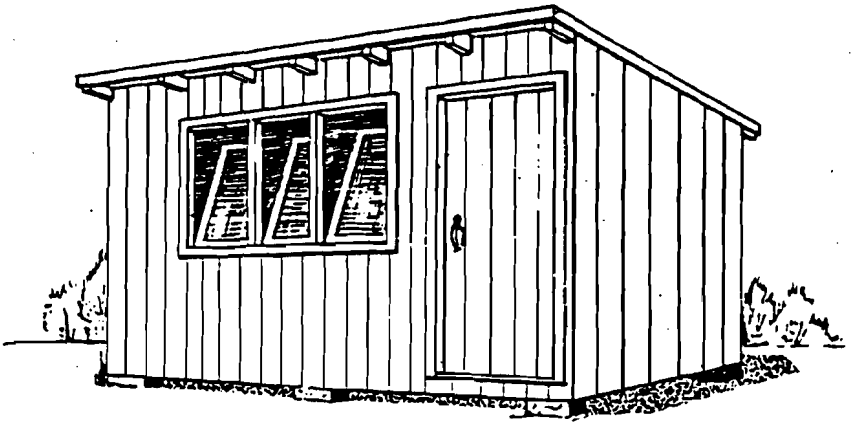
Automatic switches to control lights are inexpensive and easy to install. An automatic time clock may be set to turn lights on and off at desired times. Automatic dimming devices are recommended when evening lights are used.

Shallow-dome (aluminum pie-plate) reflectors or bulbs with built-in reflectors improve the distribution of light within the poultry house.

Chapter 3

HOUSING

Housing your poultry is an important part of raising chickens. Plans for building chicken coops are included, but much variation can exist and still provide good housing. The critical items to remember are that you must provide shelter from extremes in weather, drafts, and predators. The house must include adequate ventilation to prevent ammonia build-up, have easy access for cleaning and disinfecting, and provide optimal space allocation for the birds. Plans may be modified to accomodate other numbers of birds.



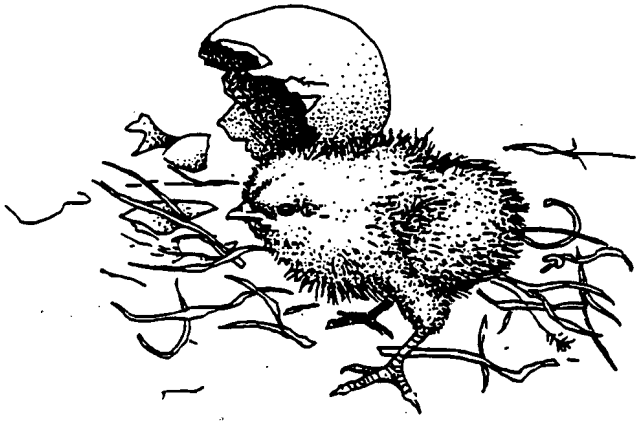
How And Where To Obtain Plans

Obtaining Plans

Plans listed above may be obtained through your local Cooperative Extension agents. You are encouraged to secure plans from them so that you can compare and evaluate other plans that they have and recommend.

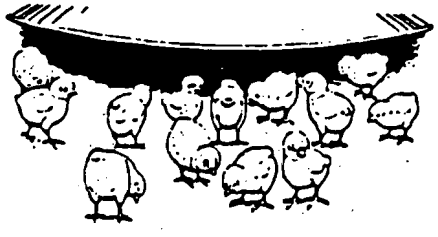
Chapter 4

BROODING



Baby chicks need the proper environment (temperature, fresh air, space, light, etc.) and good nutrition if they are to become the source of eggs, meat, or breeding stock that you want. Feed should contain all required nutrients and should be easily accessible to the chicks. Try to keep feed reasonably free from contamination by litter. It should always be free of contamination by harmful substances or those that will cause a residue problem. Chicks also need protection from predators, parasites, disease organisms, and unnecessary excitement and stresses.

A few precautions must be taken to assure that a baby chick gets off to a good start. Because at hatching time the baby chick cannot control it's body temperature to adjust to ranges of environmental temperature, you must provide the chick with sufficient warmth to make it active and keep its system operating normally. Also bear in mind that the chick has great potential for growth. Starting with a day-old weight of about 40 grams, the modern broiler chick may reach a weight of greater than four pounds in only 49 days. This means that the initial weight multiplies more than 45 times in a two month period. Such growth requires the best nutrition and minimal outside interference from the stresses mentioned earlier. And yet, with all this remarkable growth, the demands of the chick are not hard to meet. Common sense coupled with a knowledge of the bird's nutritional requirements and good management can produce this kind of growth. The following information discusses the baby chick's needs and the ways they may be met.



Supplies And Equipment

Brooding area

- a small building, a room or small area within a building, or a battery brooder (cage system).

Cleaning materials

- wheelbarrow or wagon, broom, shovel, pails, water, lye, pair of rubbers or boots, Carbolineum, and brush.

Brooder

- a gas, coal, wood, or oil brooder that will heat the brooding room and the area under the brooder. Electric brooders or infrared lamps heat only the area under the brooder; they are not recommended during seasons when night temperatures are very low. Electric brooders may be used in extremely cold weather if the room temperature is kept about 45°F. Small numbers of birds can be brooded in a box indoors with a regular light bulb.

Litter

- shavings, sawdust, chopped straw, peat moss, crushed sugar cane (Stazdry), oat hulls, or other dry, absorbent material can be used. Never use smooth, flat material because it will cause leg deformities.

Chick guard

- a circular cardboard or metal barrier should surround the heat source, approximately 25-feet long by 18-inches high, to minimize drafts and prevent the chicks from piling in corners and suffocating.

Feeders

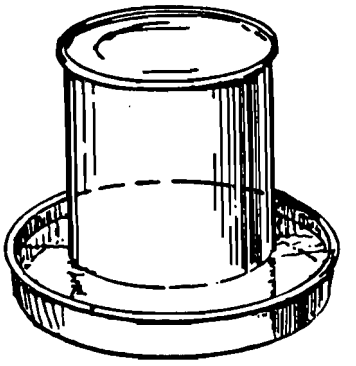
- egg cartons or a box top should be used for the first few days, then wooden or metal hoppers.

Feed

- chick starter mash should be used during the first 3 weeks.

Waterers and water stands

- waterers can be made from a pie tin with a tin can containing small holes in the top edge then inverted over the pie tin.



Lights

- one 75-watt incandescent or 13-watt fluoresent bulb for every 200 square feet of brooder space.

Roosts

- install roosts in the brooder house when the chicks are four to six weeks old if roosts will be used in the laying house.

CHECKLIST

1. Thoroughly clean the brooding area making sure all dust, debris, and insects are eliminated.

2. Screen all openings to prevent the entry of wild birds or rodents. Replace broken window panes.

3. Thoroughly clean and adjust all equipment.

4. Install a draft shield or brooder guard to keep the chicks near the heat source until they learn to find it on there own.

5. Put two to four inches of good absorbent litter on the floor. all litter should be dry and free from molds. Clean, coarse, woven cloth or rough surfaces paper can be used to cover litter for the first few days and then removed. Do not use a smooth material for litter. It will cause leg deformities.

6. Place the feeders and waterers in the brooding area and fill to a level easily reached by the chicks. Additional feed can be placed in flat trays, paper towels, or egg case filler-flats for the first few days.

7. Operate the brooder to dry and warm the building. Check the brooder's temperature with an accurate thermometer. (You may want to have two thermometers to check one against the other.) Make sure the brooders are on and working for 24 - 48 hours before the arrival of the chicks.

8. Place the chicks in the heated area. It's good practice to dip each chick's beak in water as it is removed from the chick box so it knows where the water is located. If dipping every chick is not practical, at least some of the chicks in each area should be trained and the others will copy them.

Prepare For The Arrival Of The Chicks

If disinfectants and/or insecticides are used at the time of cleaning, be sure the building has been completely dried and well aired-out before chicks are placed in it.

Arrange feeders and waterers so they do not prevent the chicks from moving towards the heat or away from it. See page 7, Chapter 2.

When growing replacement pullets, roosts may be placed in the brooder house by at least 4-5 weeks of age. However, to avoid breast blisters, they probably should not be used for broilers or roasters.

Sufficient ventilation should be provided so the air smells reasonably sweet and fresh. At no time should the air cause a burning sensation in the eyes or nose. This indicates a lack of ventilation. If you can smell the ammonia, the level is about 20 parts per million (ppm) and is harmful to the birds. Remember, the ammonia is always stronger at the bird's height than at yours.

Litter should be replaced (or stirred) if it becomes damp or soggy or if a continuous cover of manure appears on the surface.

It's a good idea to provide light at all times for the first three or four days. After that, 8-12 hours of natural light per day is sufficient. If night lights are used to provide up to 23 hours of light, they should be dim. When brooding with light bulbs, red ones are preferred over white bulbs as they do not appear so bright and, therefore, chicks will be less nervous.

After the first week or so the chicks will usually settle down for the night in a ring around the heat source. There should always be an open space in the center so that those who are cool can move in. Conversely, there should always be space outside of the circle for the warmer birds to move outward. Experienced poultry producers find the positioning of the chicks around the heat source more reliable than a thermometer. The chicks should be comfortable regardless of temperature figures.

MANAGEMENT TIPS

1. Clean and refill waterers daily.

2. Keep a supply of fresh, clean feed in front of chicks at all times.

3. Raise or change to larger feeders and waterers as chicks grow. (The lip of the feeder should be at the height of a chick's back).

4. Do not overfill feeders. To do so wastes feed. About half full is enough at any one time. Refill as needed but at least once a day. Old or stale feed is not appetizing to chicks and may be harmful if it becomes moldy.

5. Provide at least 1/2 inch waterer space and two inches of feeder space for each chick, more after eight weeks of age.

6. Provide adequate protection against predators.

7. Watch your birds daily for unusual behavior. Failure to eat, drink, or react normally indicate a problem. A good history by an observant caretaker can help when diagnosing a problem and getting treatment.

8. If death loss occurs, find out why from either a public diagnostic facility or a veterinarian who specializes in poultry diseases. Give medicines or treatments only after you know what you are treating.

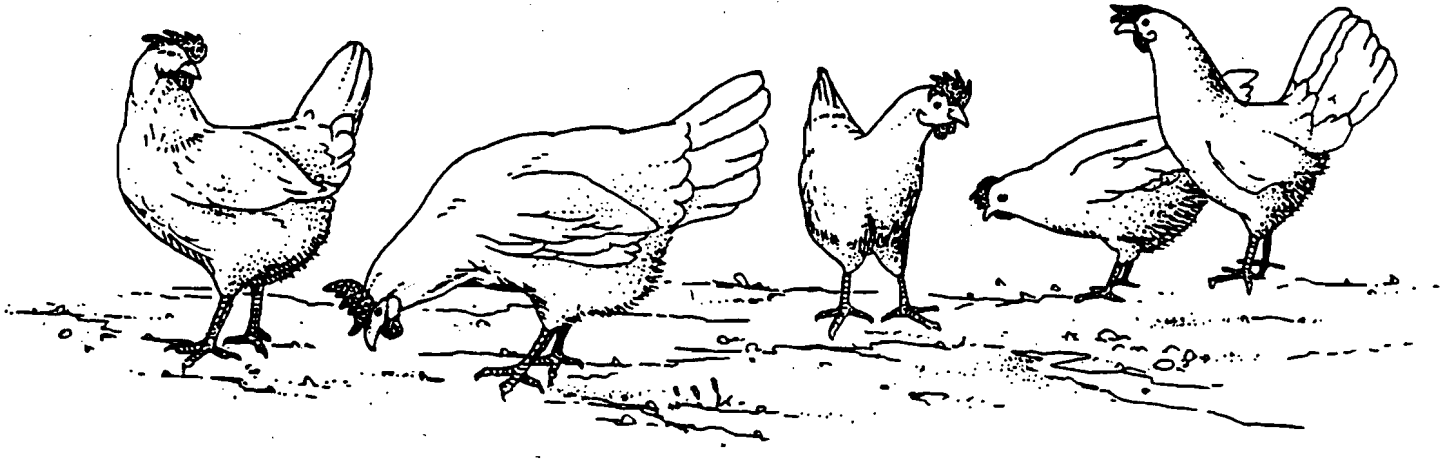
Note: *For regular size (not bantam) chickens, feeders should be two inches high by two weeks of age, three inches high by four weeks, and five inches high by eight weeks of age, so they are raised as the birds grow.*

Chapter 5

LAYER MANAGEMENT

Many strains of egg layers exist. The most popular commercial egg layer is the Single Comb White Leghorn. Leghorns can lay up to 300 eggs in their first year. Other strains do not do quite as well but can be very popular. To determine the color of egg a hen will lay, simply look at the earlobe. A white earlobe is indicative of white eggs and a red earlobe is indicative of brown eggs.

You may purchase egg layers as chicks or pullets. When buying chicks, you usually have to buy straight-run (a mix of both sexes) and cull the males. There is also the additional cost of feeding the chicks for 22 weeks before the first egg is laid. Pullets (immature female chickens) are more expensive to buy but will start laying eggs within weeks of your purchase. You must determine which option best suits your situation.



Equipment Needs

Roosts

Roosts are not essential, but they are preferred by many growers. Be sure to allow sufficient space because birds may injure themselves fighting for roosting space. Always introduce roosts at approximately 4 weeks of age if you plan to use them with adult birds.

Nests

Properly designed nests with clean litter should be provided for laying hens. Individual or community nests work well. Dark nests promote use so place a cloth flap to cover two-thirds of each opening. Install a perch below the openings for easy access.

Cages

Birds may also be housed in wire or plastic cages, in an open building or closed fan-ventilated housing. Cages make care easier, but birds in cages are more affected by extreme weather conditions. Protection from wind, cold, and hot weather must be provided. Cages are usually constructed of 1-inch by 2-inch welded wire. The floor should slope 2 inches per foot so that eggs will roll out properly. The floor should extend 8 inches beyond the front of the cage, with curved lip, so that the eggs will stop gently.

Cages can be any size but should not exceed 20 inches in depth for best results. Cages 12 inches wide and 18 inches deep are very popular. Allow 4 inches of cage front per Leghorn hen (3 hens in a 12" X 18" cage). Larger breeds require 6 inches of cage front per bird (2 hens in a 12" X 18" cage).

A common arrangement is to place 2 rows of cages back to back with a line of feeders on the front of each cage row and a 1 1/2- to 2 inch-deep V-shaped water trough or line of poultry drinking cups at the back between the cage rows. The feed troughs should be about 4 inches deep, 6 to 7 inches wide at the top, and slope inward to between 3 and 4 inches at the bottom. The inside top of the trough should have a 1- to 1 1/2-inch lip to reduce feed wastage.

Recommended Management Practices for Layers

Age of bird	Temp. °F	Floor space sq.ft.	Light	Feeder space	Water space	Ventilation	Roost
0-6 wks	*	*	*	*	*	*	intro at 4 wks
22 wks	room***		14 h/day			*	8 in/bird
78 wks	room***	1.75**	14 h/day	44.8	1	*	8 in/bird

**for layers raised on the floor on litter, less space is needed on wire floors

***optimum performance occurs between 60°F and 80°F

Management For Egg Production

Lighting

Artificial light should be started when pullets reach 22 weeks of age. Do not light them at a young age because the immature body is not prepared for egg production and is prone to prolapse. Prolapse is a fatal condition in which the uterus actually everts to the outside of the body.

Under natural daylight conditions chickens will usually lay most of their eggs in the spring, as the days lengthen. Hours of daylight influence a bird's sexual maturity and resultant egg-laying. (More information can be found in the Breeding and Genetics section.) Higher, more consistent egg production can be obtained if artificial light is provided.

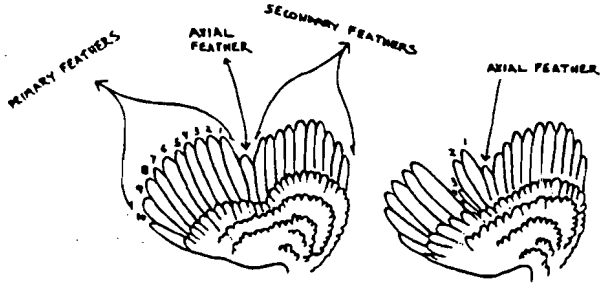
A useful lighting rule of thumb is that the length of light period should never be allowed to decrease. A minimum of 14 hours of light per day is recommended. All-night lights can be used but are not recommended because they will lower production and waste electricity. An inexpensive timer will save electric costs. One 40-watt incandescent bulb placed in the center of the pen provides adequate light for up to 100 hens. In general, you need 1 watt for every 5 square feet of pen to be lighted. If you can just barely read a newspaper in your hen house, the hens are receiving adequate light for peak egg production.

Age And Expected Egg Production

Chickens lay best during their first production year, which starts at about 22 weeks of age. They reach a peak production of 80-95 percent at about 34 weeks. Following this peak, the production rate will decline until a molt occurs. Commercial flocks are usually processed for meat after 14 to 20 months of egg production, unless they are force molted.

Molting

Molting, or feather loss, is a natural occurrence in chickens; its frequency varies according to inheritance and environment. Breeds and strains that have been selected for high egg production are less prone to frequent molting. Hens may molt if feed or water is withheld, during cold weather, decreasing light periods, or during disease outbreaks.



When a natural molt occurs, egg production usually stops for 2-6 weeks. In commercial flocks, uniform molting is induced at

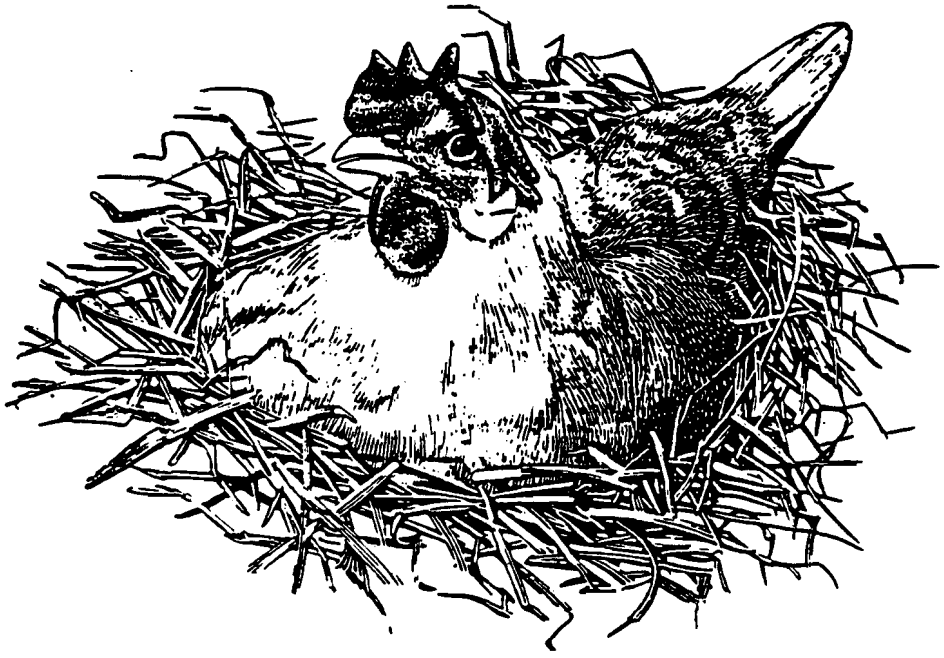
regular intervals to improve egg production and quality.

Winter production pauses accompanied by a molt are common in small flocks. They can be prevented to some extent by providing proper lighting, adequate protection from cold weather, and feed and water at all times.

Random pauses in egg production will occur with most hens some time after the first year of lay and will recur periodically if hens are kept beyond 2 years of age.

Broodiness

Broodiness can be a worthwhile characteristic when natural reproduction is desired, but it is not compatible with high egg production. A broody hen will sit on her nest as if she were incubating eggs. However, during this time she will not lay eggs. Broodiness may be halted by placing broody hens in a wire-floored cage for 5-7 days.



Culling

Culling is the removal of poor layers from the flock. It can be a useful practice, particularly as hens pass 1 year of age. Poor layers will consume feed worth more than the value of the eggs they lay. These birds may be eaten if they are not sick. Sick hens should be removed from the flock and disposed of immediately.

CHARACTERISTICS OF A LAYING HEN	CHARACTERISTICS OF A NONLAYING HEN
- a bright red comb	- a dull, shriveled comb
- a soft, pliable abdomen	- a hard and often fat abdomen
- a large, oval, moist vent	- 1 to 2 fingers' spread between pubic bones and between pubic bones and keel
- 3 to 4 fingers' spread between pubic bones and keel	- molting and growing of new feathers
- no molting or growing of new feathers	

Cannibalism

Chickens instinctively begin to peck soon after they are hatched and they carry on this habit throughout their lives. Pecking is useful since chickens learn to eat with almost no training. However, if the birds begin to peck each other, injury and death often result.

Cannibalism is difficult to control once it has started. Prevention by control of the contributing factors is recommended. Additional control can be accomplished by beak-trimming or using of anti-pick devices. See Meat Bird Management for further details.

Anti-pick Devices

Several devices have been used to prevent picking in adult birds. These include bits, specs, and pick guards of various designs. They can easily be attached and have the advantage of not requiring special instruments. For additional information contact your land grant university cooperative extension service.

Care Of Eggs

Egg quality is important and proper care can minimize problems. Keep adequate nesting material in nests, maintain floor litter in good condition, and gather eggs frequently to minimize dirty egg problems. Frequent gathering reduces the number of checked and broken eggs and discourages the practice of egg eating. Eggs to be marketed should be candled to remove those containing blood spots or other interior quality defects. Pack only eggs that are clean and of uniform size in order to have an attractive looking appearance in the carton.

The best storage condition for eggs is at 55°F with 80-85 percent relative humidity.

A household refrigerator can be used to store eggs from small flocks, but the low humidity will cause air cells to enlarge rapidly. Eggs may absorb off-flavors if stored with other produce such as onions.

Sandpaper, emery paper, or steel wool are useful for dry cleaning eggs. Egg washing is not recommended for small flock owners, but if done, an egg wash containing a sanitizer should be used. A temperature of 110°F is preferred but a range of 90-100°F is suggested. Make sure the water is at least 20°F warmer than the egg but never more than 50°F. Washing should not exceed 2 to 3 minutes and should be followed by rapid drying and cooling. Never wash eggs in cold water. It causes the egg contents to contract and draw-in the dirty water.

Egg quality declines as eggs get older, but the nutritional value is not affected. For maximum quality, eggs should be used within 2 weeks after being laid.

Freezing Eggs

To freeze the white and yolk of eggs together, break the eggs and thoroughly mix the yolk and white. Use an electric mixer at low speed to avoid incorporating any more air than is necessary. No further treatment is needed. Pour the mixture into containers and freeze.

If you plan to freeze whites and yolks separately, separate the eggs in the usual way. Be careful to avoid getting any yolk into the whites; they will not whip if mixed with yolk. Mix the whites to a smooth foam-free consistency.

Freeze in a suitable container. The frozen, separated yolks will gel unless salt or sugar is added when they are mixed. Add 1 teaspoon of salt or 2 tablespoons of sugar, corn syrup, or honey to each cup of yolks. Remember to allow for the salt and sugar in the added ingredients when using frozen yolks in recipes.

Marketing

Surplus eggs are often marketed by small flock owners. State laws may establish certain minimum grade standards, sizes, and labeling instructions for shell eggs. Consult your State Agricultural Department for details about these regulations.

MANAGEMENT TIPS

1. Keep waterers and feeders clean of foreign material.
2. Check birds daily.
3. Fill feeders only half full to prevent wastage.
4. Gather eggs as often as possible; 3 times daily is optimal.
5. Provide adequate feeder and waterer space.
6. Supply enough feeders and waterers and at the correct height for the birds as they grow.
7. Do not allow the birds to go hungry or thirsty.

Chapter 6

MEAT BIRD MANAGEMENT

Meat birds are raised for 7 to 12 weeks and are excellent summer projects to put meat on your table. There are many breeds of chickens acceptable for meat production. The commercial strain you may obtain is a cross between a Plymouth Rock (American class) and Cornish (English class). If you decide to raise a dual purpose breed, you may slaughter the males when they reach the desired weight and keep the females for egg production at approximately 22 weeks of age.

It is very important that you buy your chicks from reputable National Poultry Improvement Plan (NPIP) certified hatcheries. You will have greater success if the chicks are beak-trimmed and vaccinated for Marek's disease.

Dressed chickens are known and sold by the following designations. Keep in mind that the dressed weight will be approximately 70% of the live weight.

Broiler: a young chicken, either sex, usually 7-9 weeks of age and weighing approximately 4 pounds.

Roaster: a young chicken, either sex, weighing 5 pounds or more and usually 12-20 weeks of age.

Stewer: an adult hen, often the by-product of egg production.

Water And Feed Consumption

When buying feed it is advantageous to know how much to purchase. See Feeding section for instructions on storing feed.

The following chart will help you determine your feed needs.

Pounds Of Feed Required To Raise Ten Chickens

BROILERS TO 8 WEEKS	90-110
ROASTERS TO 16 WEEKS	200-240

Monitoring water consumption is a good method to check the health status of your birds. A sick bird tends not to drink adequately. In addition, many medications are given in drinking water so it is critical to know how much a typical bird drinks. Water consumption is also a good way to access proper management technique. If a water trough is at an improper height or if there aren't enough troughs, a bird will not be able to drink enough.

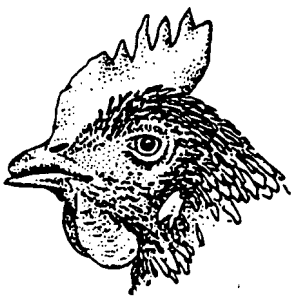
Water Consumption Of Broilers

Age in weeks	Gallons/100 birds/day
0-2	1.0-1.5
2-4	2.5-3.2
4-6	3.7-4.3
6-8	5.0-5.5

Cannibalism

Cannibalism can be a problem with chickens. Birds tend to get bored and pick at everything, including each other. In extreme cases, a bird can be pecked to death. Always remove dead chickens as soon as possible since they attract pests and spread disease. Factors contributing to cannibalism are: crowding, nutrient deficiencies, too much light, too much heat (hot weather), idleness, blood on injured birds, and inadequate eating or drinking space. There are three ways to prevent cannibalism. You can dim the lights to the point that you can barely read a newspaper; decrease the flock density, that is, reduce the crowding; or you can trim the beak of each chicken. Beak-trimming doesn't stop the picking; it just reduces the damage when a bird is pecked.

Beak-trimming



Beak-trimming is a recommended and simple operation. Chickens can be beak-trimmed at any age. Remove about two-thirds of the upper beak and one-third of the lower beak with a heated blade. The heated blade cauterizes the cut to prevent regrowth, bleeding, or infection. A special instrument known as a beak-trimmer is used.

Several methods of beak trimming have been used. You may simply use dog toenail clippers and remove approximately one-third of the upper beak. Make sure you do not trim up to the nostrils and be careful not to crack the beak of older birds. At the hatchery a cauterizing blade is used so bleeding does not occur. Use septic powder to inhibit bleeding at home. In an emergency, mash feed will stop the bleeding. A soldering iron may be used to cauterize the wound. It will take about 8 weeks for the beak to grow back and require clipping.

Vaccination

Due to the short lives of meat birds, it is usually not necessary to vaccinate against diseases other than Marek's. Chicks can be bought from the hatchery that have been vaccinated and will cost only a few cents more per bird. If you keep birds for a breeder flock, follow the directions in the Biosecurity chapter.

Litter

Clean, dry litter will help maintain the health of your flock. Apply 2-4 inches of litter on the floor on the pen. Litter can consist of straw, ground corn cobs, or wood shavings. Sand or sawdust is not a good material because young chickens may eat it resulting in a compacted crop.

Keep the litter dry! Wet litter will spread disease. Remove wet litter from around waterers frequently. When the litter becomes soiled as the birds age, add another 2 inches of litter material to the pen. Some people like to throw scratch grain into the pen. The chickens will scratch at the litter to find the grain and in doing so will keep the litter much drier than otherwise. Change the litter for each flock.

Lighting

Provide enough light to attract chicks to the feed and water during the first few days of life. Using a 40-watt bulb in a 20' X 20' room for 23 hours per day will allow them to find the feed and water. A 23-hour light regime will promote maximum weight gains and prevent piling and suffocation at night. After the first week, this practice should be discontinued.

Ventilation

Fresh air is necessary to supply oxygen, remove ammonia fumes, and keep the litter dry. A draft or a wave of cold air directly on the birds must be avoided to keep the birds in good health. Insulated buildings allow you to ventilate more without dropping temperatures too much. Air entering a building from the rafters is termed ventilation. Air entering from the floor is a draft. Remember, it is better to have the birds at 35°F and dry rather than at 55°F and damp.

Space Requirements

Chickens perform best when they have the right amount of space. Provide at least one square foot of floor space per bird up to 10 weeks of age. More space can be allowed, but less may impair the uniform growth of the flock.

Enough feeders should be used to provide at least one linear inch of space for each bird during the first two weeks of life. As the birds grow, increase the space to four to six linear inches. This equates to 25 linear feet for troughs (measure both sides of the feeder) per 100 birds or four to six tube feeders that are 15 inches in diameter.

Three one-gallon waterers will suffice for 100 chicks during the first two weeks of life. Increase this to at least 100 linear inches per 100 chickens. Make sure that a chicken does not have to travel more than 15 feet to get to a waterer.

Recommended Management Practices for Broilers

Age of Chick (weeks)	Temp.* (F)	Floor Space (sq. ft.)	Light	Feeder Space (in./chick)	Water Space (in./chick)	Ventilation
1	90-95°	1/4	(12 hours	1-1/2	Some	(Enough to
2-3	85-90°	1/2	light or	1-1/2	at all times	make the
3-5	80-85°	3/4	daylight	2-1/2		air
5-8	70-80°	1	equivalent	2-3/4		acceptable to
8	Room	1-1/2	+ dim nightlight)	4	1	humans)

**Temperature to be taken at the height of the chick's back and at the outer edge of the heated area.*

Note: *Temperatures given here are for small flocks of standard breeds. Specialized egg and meat strains raised in modern facilites in large numbers, may be comfortable at two to three degrees lower temperatures.*

Chapter 7

FEEDING YOUR POULTRY

Feed accounts for approximately 70% of the cost of raising domestic fowl. For this reason, the concepts of nutrition should be well understood and the optimal way to manage a feeding system should be realized. This section will focus on the nutrients required for the normal growth of the fowl, its digestive system, the mixing of ingredients to achieve an ideal diet, and how to care for and feed the recommended diet.

Poultry of different ages and types require different diets. Each diet is formulated to have specific quantities of the required nutrients. In addition to the nutrient composition of a diet, many other factors are important in feeding poultry. The physical form of the diet is important and the storage of the feed will influence the quality of the diet.

Feeding poultry is not unlike feeding yourself. Some feedstuffs are high in one nutrient but low in another. That is why you must feed a variety of feedstuffs.

Common Poultry Diets

As mentioned previously, different poultry have different nutrient requirements and therefore, different diets must be fed. However, there are times when nutrient requirements overlap between types or ages of poultry, so it is possible to make some substitutions. At other times it is critical that the correct diets are provided. For instance, if an immature chicken is fed a layer ration, the calcium level will be so high that the immature chicken will experience improper bone formation, kidney failure and, hence, increased mortality. On the other hand, feeding a broiler starter ration to a layer will result in poor shell quality.

The primary concern when formulating a ration is to meet the bird's nutrient requirements. Poultry will eat feed to satisfy their energy requirements. Therefore, all other nutrients must be provided in the diet based on the amount of energy that the chicken will consume. All diets are formulated to have the proper balance of energy to other nutrients. During the summer, energy consumption is decreased so protein, vitamins and minerals must be increased in the diet. In the winter, the opposite is true.

Growing birds, turkeys, and game birds require a relatively high level of protein compared to mature chickens. In addition,

heavy meat-type chickens require more protein than the lighter egg-laying strains. Protein must be balanced with the energy content of the diet.

Minerals, vitamins and fat are also important constituents of the diet. These are required for the bird to grow and produce normally, they are generally added to complete diets in excess of their true requirements, so that if rancidity or spoiling occurs, the excess will take care of any deficiencies in the diet.

Examples of Common Diets

Nutrients, not ingredients, are the most important part of a feed. As shown below, different combinations of feed ingredients can be used to make a diet with the same nutrient composition. Ingredients are subject to change due to availability and cost.

Complete Pullet Grower

Ingredients	lbs/ton	lbs/ton	lbs/ton
Corn meal, No. 2, yellow, ground	1239	1259	1384
Wheat middlings	100	100	-
Wheat, crushed or rolled	150	-	250
Barley, pulverized	200	300	-
Soybean meal, 50% protein	120	230	225
Meat and bone scrap, 50% protein	120	-	-
Fish meal, antioxidant-treated, 60% protein	-	-	30
Alfalfa meal, 17% protein (100,000 IU Vit. A/lb)	50	50	50
Dicalcium phosphate	-	30	30
Limestone	10	20	20
Salt, iodized	5	5	5
DL-Methionine	1	1	0.6
Developer vitamin and mineral premix	5	5	5
Calculated composition			
Protein, %	14.40	14.30	14.40
Metabolizable energy, Kcal/lb	1386.00	1360.00	1394.00
Calcium, %	0.89	0.85	0.91
Phosphorus (available), %	0.41	0.39	0.42
Lysine, % of protein	4.30	4.40	4.60
Methionine, % of protein	2.00	2.00	2.00
Cystine, % of protein	1.80	1.80	1.80

Nutrient Requirements

The following table lists the major nutrient requirements for different ages and types of chickens.

Nutrient requirements of chickens*

Bird type	Energy Kcal/Kg	Protein %	Ca %	P %	Diet
EGG LAYERS					
Growing:					
0-6 wks	2900	18	0.8	0.4	Starter
6-14 wks	2900	15	0.7	.35	Grower
14-20 wks	2900	12	0.6	.30	Developer
Laying	2900	14.5	3.4	.32	Layer
Breeding	2900	14.5	3.4	.32	Layer
MEAT BIRDS					
0-3 wks	3200	23	1.0	.45	Starter
3-6 wks	3200	20	.9	.4	Grower
6-8 wks	3200	18	.8	.35	Finisher
breeders	2850	14.5	2.75	.25	Breeder

** Nutrient requirements for turkeys, geese, ducks and game birds can be found in Nutrient Requirements of Poultry, 1984 edition.*

Most people do not want to feed their meat birds three different diets during the eight to twelve weeks that they are raised because it is difficult to buy small quantities of feed and secondly, larger quantities are more economical. Therefore, it is common to purchase a 20% protein feed for meat birds which you can feed for the bird's lifetime.

Average Feed Consumption

You must have an estimate of the amount of feed that a bird will consume. This will help determine the amount of feed to buy and the cost of raising your birds. The following chart contains estimates of feed consumption. Note that the figures were determined using diets formulated according to the NRC's (National Research Council) nutrient requirements so they may be somewhat different than the diet you feed.

Cumulative Feed Consumption of Poultry at Specific Ages

Bird Type	Age (weeks)	Feed Consumption (lbs)	
		M	F
Leghorns	8	-	2
	22	-	9
	70	-	20
Broilers	8	12	10

Feeding For Egg Production

(Leghorns, other egg layers, and dual purpose breeds)

Egg layers have specialized needs. The starter feed (0-6 weeks) is high in protein to accommodate the growth of a young bird. The grower feed (6-14 weeks) contains less protein and the developer feed (14 weeks to start of egg production) even less. By the time the bird is 14 weeks of age, it has almost finished growing and high protein is not needed.

When the bird begins egg production, feed the laying ration. Make sure that you do not feed the laying ration more than two weeks before the bird begins to lay. This will cause improper bone development. A leghorn hen begins to lay eggs at approximately 18-22 weeks of age if she matures during the spring. A hen maturing during the fall or winter will need a larger body size before production begins, so a few more days may be required.

If you are not lighting your birds to maintain production during short daylight months, remove the layer feed during the molt and replace it with the developer feed. Always replace the laying feed when eggs are again laid or the bird will be thrown out of production due to the low calcium diet.

Feeding For Meat Production

(Dual purpose, commercial meat crosses. Not for egg strains)

Meat birds also have special dietary needs. Due to the rapid weight gains of a meat bird, high protein diets are fed. A coccidiostat is generally added to the diets of pullets, breeders, and meat birds that are raised on the floor. The coccidiostat will keep the birds from being infected with the intestinal worm called coccidia.

The finisher diet (final 10 days before slaughter) gives birds a slight finish of fat, hence, the lower protein and high energy content diet. In addition, no coccidiostat is added. The withdrawal time for removing the coccidiostat drugs from the feed must be followed, or else residues will appear in the final meat product. Do not feed the finisher for more than about two weeks as an overly fat bird will result.

When raising roasters, a different feeding schedule should be followed. Roasters are

raised for approximately 12 weeks, although some are kept for five months. Begin by feeding the broiler starter diet. At two weeks of age feed a pullet starter or grower diet until approximately 12 weeks. The pullet feed will have less energy and the roaster will not put on too much fat. Feed the broiler grower diet until your birds almost reach the desired weight. At that time always feed a coccidiostat-free finisher diet for 7-10 days before slaughter.

Feeding Roasters

AGE (Weeks)	DIET
0-2	Broiler Starter
2-12	Pullet Starter
12-Desired Weight	Broiler Grower
Desired weight	Finisher

Feeding Programs

Complete Diet

Complete feeding utilizes a diet that needs no additional supplements. It may be purchased as mash, crumbles or pellets. This is generally an easy way to feed chickens. It enables you to fill up a tube feeder from one bag rather than using several different feeds. In addition, you are insured that your birds are receiving the best possible diet and that you will reap the benefits of healthy productive birds.

Complete-Grain Feeding

The complete-grain system is economical because only half of the diet must be ground and mixed at the feed mill. This system is easy to use when feeding Leghorns since they tend to balance the consumption of grain and mash. Heavy hens, however, tend to eat more grain, so more feeders with the mash diet than the grain diet must be provided.

When feeding grain, a grit source should be available. Additional mechanical grinding in the gizzard is required and grit conditions the gizzard as well as providing more surface area for the grinding action.

Concentrate-Grain Feeding

This feeding technique allows for grain to be offered throughout the day. The high protein concentrate is fed early in the morning so make sure that all birds have access to the feeder. An alternative method involves mixing the concentrate and the grain in a ratio of approximately 1 part concentrate to 3 or 4 parts grain. This is, of course, labor intensive. As with any feeding program where grain is fed, grit should be available at all times.

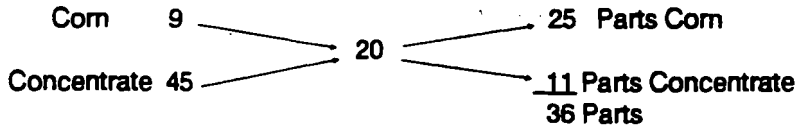
Feed Formulation

When formulating a diet for chickens (or other animals and humans) the primary goal is to insure that the diet contains the essential nutrients. Tables of nutrient requirements can be found in the NRC publication, Nutrient Requirements of Poultry. Based on the requirements, ingredients must be selected that supply the necessary nutrients. Computers are commonly used for feed formulation on a commercial scale. However, hand formulation can be utilized for research and small-scale production.

The following section describes a simple way to determine the amount of a scratch grain to feed with a concentrate (feed high in protein). In these cases, the concentrate has already been formulated to the desired nutrient content.

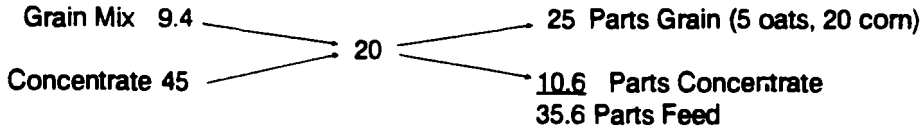
The Square Method Of Formulating Diets

Problem 1: Calculate the amount of corn and poultry concentrate required to produce a 20% chick starting ration. The corn contains 9% protein and the concentrate, 45% protein. Cross subtract the known quantities of protein with the desired amount to arrive at the proportion of the total ration of the other ingredient.



% Corn = 25/36 X 100 = 69.4
% Concentrate = 11/36 X 100 = 30.6
Total % = 100

Problem 2: Calculate a 20% starting ration containing 2 or more grains and a 45% concentrate by using 8 parts of a 9% protein corn and 2 parts of an 11% protein oat.



% Oats = 5/35.6 X 100 = 14
% Corn = 20/35.6 X 100 = 56.2
% Concentrate = 10.6/35.6 X 100 = 29.8
Total % = 100

Feed Handling

Feed handling is important to providing your birds with adequate nutrition. Nutrients will be destroyed with extended holding times. Fat will become rancid and render the fat-soluble vitamins inactive. Mold and bacteria can grow in the rich nutrient environment of feed, causing illness and lowering your flock's production performance.

Simple techniques to avoid these disastrous occurrences are given. It may not be possible to follow them exactly, but every effort should be made to provide high quality feed.

- Never store feed for longer than 1 month in the summer months and 2 months during the winter.

- Store feed in watertight, non-metal containers. Metal increases the chances of rancidity and destruction of vitamins. Always allow the birds to consume all of the feed in the feeder at least once a week.

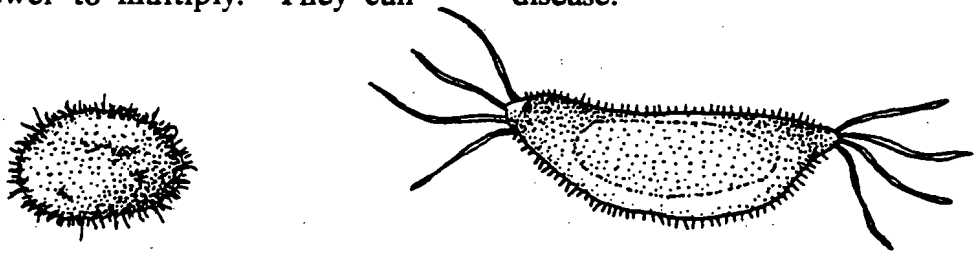
- Feed that stays in the feeder will have the same problems as stored feed.

- Clean out the entire feeder system each time you remove a flock of birds.

Chapter 8

BIOSECURITY FOR POULTRY

Biosecurity means preventing the spread of disease-producing germs. Germs are so small that a million of them could fit on the head of a pin. Germs also have an amazing power to multiply. They can create a population as large as all of the people on earth in a single day. With these things is mind, you are on your way to understanding what it really takes to prevent disease.



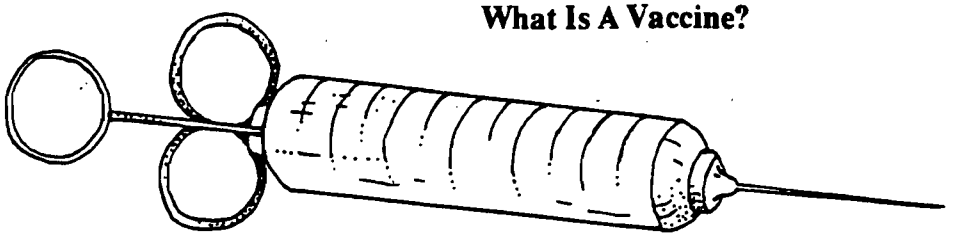
Defense Against The Microbe

Every day chickens come into contact with millions of potentially disease-producing agents. The reason they do not succumb to these is because of the immune system. The immune system is quite diverse and is the body's defense against a myriad of microorganisms.

The immune system is miraculous but not perfect. Many factors exist which will alter the effectiveness of the body's defense. Stress will especially knock down a bird's defenses. Stress may be encountered as hunger, lack of water, dirty environment, heat, cold, or crowding. These factors are all within your power to change, so you play a major role in the continued health of your birds.

When a microorganism enters the body, cells produce antibodies to fight them. The cells that produce antibodies are called lymphocytes before infection, and plasma cells after infection. After infection, plasma cells produce the antibodies in large number. It generally takes 4 to 5 days before enough antibodies are formed to effectively destroy the invading microorganisms. Once the antibodies have been induced and the infection is gone, the body maintains memory cells. The memory cells remember the exact type of antibody required to fight a specific disease. Once that same disease infects the body again, the antibodies can be manufactured more quickly and the disease organism destroyed faster.

What Is A Vaccine?



Disease-producing microorganisms come in many forms. They exist in various sizes, from the smallest, a virus, through bacteria, fungi, protozoa, and to the largest, the parasite. Most are sensitive to drugs or antibiotics. However, there is no treatment for a viral infection. The best defense against a virus is prevention. Vaccination is one method used to prevent a virus from infecting an animal. Here is how it works:

When a virus enters the chicken's body, the immune system produces antibodies which attack this foreign substance. Once antibodies are produced, they remain in the bloodstream. If the same virus attacks again, the antibodies are there, waiting to defend the chickens' body. Sometimes the antibodies will last a lifetime, other times the chicken will remain immune for only a specific time period.

A vaccine is actually a virus and a vaccination is the inoculation of a small quantity of a specific virus into an animal. The first vaccination was performed in humans in 1796 by Edward Jenner. He observed that individuals who had contracted cowpox, a mild disease, were immune to smallpox. We now know that the two viruses are so similar that the antibodies produced by exposure to cowpox are also effective against smallpox. Scientists have determined that small quantities of a virus will give animals such a mild case of the disease that they remain strong enough to fight the disease.

Generally, chickens will show very minor signs of the disease with which they have been vaccinated. Chickens vaccinated for Newcastle or Bronchitis will sometimes show mild respiratory signs during the first week. A small percentage of birds vaccinated for laryngotracheitis by eye drop generally show watery eyes 4 to 8 days post-vaccination. These recover without complications. Birds vaccinated by drinking water may show mild respiratory signs during the first week after vaccination. Take these minor symptoms as evidence that the vaccination is working. Also realize that the birds are being stressed and extra care should be taken that additional stress is not encountered (extreme temperatures, lack of feed and water, overcrowding).

Vaccination Of Small Poultry Flocks

Disease control is important in raising poultry. Prevention is the most effective way of attaining disease control and one method of prevention is to vaccinate your birds. However, vaccination is useless and expensive unless coupled with adequate sanitation and preventive practices. Remember, no matter how strictly you may adhere to the proper vaccination schedule, if you do not provide the correct biosecure environment for the poultry, they may still become diseased. The disease may be a more severe form of one for which you are vaccinating or against which they have no

protection. There may be no other recourse than to destroy your flock and start over. The poultry farmer that follows the practices listed below may not need to vaccinate at all.

- Buy chicks and pullets from reliable sources that are NPIP tested.
- Follow the principle of all-in, all-out. Also avoid mixing species.
- Isolate your flock from other poultry, wild birds, insects and animals.
- Prevent unnecessary human traffic through the poultry area.
- Avoid using contaminated equipment. Thoroughly clean and sanitize between use and routinely during use.
- Keep free-flying birds, rodents, pets, and insects to a minimum.

Clean And Disinfect

Prevention is the best cure for poultry disease. Proper, routine cleaning and disinfection of your poultry premises and equipment will save you money and time. Although the terms cleaning and disinfecting are used simultaneously, they actually mean different things.

Cleaning is the physical removal of dirt, manure, feed, and other miscellaneous material from poultry housing and equipment. Generally, extremely hot water is used for this step. Disinfecting means the use of disinfectants proven to kill bacteria, fungus, mold, etc. While disinfectants are important, they cannot do their job on large clumps of manure and dirt. That is why cleaning is so critical to the overall success of your endeavor. A thorough cleaning and disinfecting program is recommended twice yearly. This may be adjusted depending upon the number of birds you own and the build-up of material during the year.

The first step in sanitizing your premises is to collect all equipment needed. Gather brooms, scrub brushes, buckets, hot water (preferably high pressure), detergent, shovels, wheelbarrows, etc. Next, remove all poultry equipment, if possible. Clean all manure and dirt from the surfaces with hot water. Allow the sun to dry the equipment as the ultraviolet rays will destroy many microbes.

Before cleaning the house itself, spray a mist of water on the walls and in the pen. Otherwise, the dust that you raise during the cleaning process will remain in the house. Dust particles are notorious for carrying many disease organisms. Next, remove manure, feathers, feed, and other materials from the pen. Sweep the ceiling, walls, and floor to remove any remaining material. Now you are ready for washing with hot water. The preferred method is to use a hot water spray. If you do not have access to this equipment, use hot water and a scrub brush or sponge. Start with the ceiling, then the walls, and finally the floor. Scrape, soak, and scrub any particles remaining in the house. Pay particular attention to cracks and crevices. Remember, your main objective is to remove all particles of material with extremely hot water.

Once you have cleaned the house and equipment, you must disinfect. Use an approved detergent or sanitizer and apply it to the house, ceiling first, then walls, and final-

ly the floor. Disinfecting dirt and dust that you missed during the cleaning step is ineffective. **You must have clean premises to fully rely on your disinfectant.**

Don't forget the outside of your chicken house. Make sure that adhering dust and manure are removed and the premises disinfected. Disease organisms will live in any organic material you leave behind and will eventually find a way into the house.

Leave your house empty for at least one week after cleaning and disinfecting. Disease organisms will quickly die without the organic matter from which to feed. If you maintain birds all year, try to have two separate growing areas that are not located right next to one another. Clean and disinfect one area at a time. Realize, however, that this method will not be nearly as effective as the one described above.

While the house is empty, it is a good time to apply chemicals for the prevention of external parasites (lice and mites). Numerous products exist which can be painted or sprayed onto the premises. Painting solutions are prepared by mixing insecticides with kerosene, diesel oil, or water. Make sure to sufficiently coat all cracks, crevices and rough areas. Do not contaminate the feed and water equipment.

Disinfectants And Their Use

1. **Quaternary ammonium compounds**-are effective against a wide variety of microorganisms including some fungi and viruses, but ineffective against bacterial or fungal spores. They are fast-acting, relatively nontoxic, have long residual action, odorless, non-irritating, non-corrosive, and are relatively non-toxic. The effectiveness of "Quats" is reduced by soaps and detergents; however, most "Quats" have a detergent action. Hard water also reduces their effectiveness.

2. Numerous disinfectants are based on cresylic acid and xylenols obtained from **coal tar distillates**. They vary in effectiveness, but most are active against bacteria, some fungi, and some viruses. They are fast-acting, have residual activity, and are not affected by hard water or

3. **Synthetic phenols**-vary widely in effectiveness due to composition differences. They are effective against some bacteria, fungi, and some viruses. They are not effective against bacterial spores. Phenols act rapidly and are not inactivated by organic matter.

4. **Chlorine compounds**-usually are hypochlorites that release active chlorine which is effective against most bacteria, fungi, some bacterial spores, and some viruses. They are unaffected by hard water, kill very rapidly, have little residual activity, and are inactivated by organic matter and formalin fumigation.

5. **Fumigants**-such as formaldehyde, formalin, and paraformaldehyde are not commonly used in poultry houses or on equipment. They are frequently used in tightly enclosed spaces such as hatcheries and incubators. Methyl bromide, one of the most effective fumigants, is very toxic to man, other animals and plants-BE CAREFUL! Another effective but highly explosive fumigant is ethylene oxide; it is not recommended for general use.

In all cases, follow instructions carefully and select the proper disinfectant.

Dead Bird Disposal

Mortality normally occurs in poultry flocks. The number of dead birds will vary depending on the size of your flock. Dead bird disposal is an important step in you biosecurity practices. Never leave a dead bird in the poultry pen. If a transmissible disease agent caused the death, the further exposure to the disease agent will endanger the health of the rest of the flock. In addition, birds left to spoil, regardless of the cause of death, will contaminate other birds that pick at the carcass.

Two common methods exist to dispose of dead birds. One is incineration (burning) and the other is burying. If you choose incineration, you must select a safe location. Complete destruction of the body tissues is necessary to prevent the disease from spreading. Incineration is generally more expensive than other forms of dead bird disposal. Fuel is required and it is best to sandwich the birds between layers of fuel.

When burying birds, be sure that they are at least 3 feet underground and firmly covered. They will decompose quickly if placed in a dry or well-drained hole. Every time you bury a bird you must completely cover the birds to prevent animals from digging them up and spreading disease. Check your county regulations for the permitted burial distance from wells and above the water table.

Procedure For Diagnosing Flock Illness

When your chickens show signs of illness you have two options. The first is to consult with a diagnostic laboratory and the second is to attempt a diagnosis yourself. A diagnostic veterinarian will provide a more exact diagnosis, but often, circumstances may not allow you to utilize their services.

If you observe one bird that is behaving abnormally you should isolate and/or kill it immediately. If you're lucky you may prevent the disease organism from spreading to the remainder of the flock. As previously mentioned, viral diseases cannot be cured by medication. When birds do survive a viral disease they commonly act as carriers and will infect any other bird they may contact.

Before you have any trouble with your flock get the phone number of the closest diagnostic laboratory. A visit to the facility will familiarize you with the procedure so that you may act quickly in an emergency. You may want to consider taking a 4-H club with you as a field trip.

The laboratory must have specific information in order to submit a reliable diagnosis. You must supply the flock history. This includes the age of the flock, prior vaccinations, breed, hatchery source, feeding program, number of birds already dead, time the symptoms were first noticed, management practices such as cage reared, floor pen, or free-range, medication, and the symptoms you have observed.

The diagnostic veterinarian will examine the bird in many ways. Initially, a gross examination will be completed. This involves looking for unusual lesions or abnormalities, both internally and externally, that can be seen by the naked eye. Based on the history of the flock, the veterinarian may then conduct microbiological tests, his-

topathology (look at tissue slices), and serology (examine blood). Remember, none of the tests will be reliable if you have not provided a complete flock history or if the birds you bring in are in poor condition.

When bringing birds to the diagnostic veterinarian, it is best to bring live birds exhibiting various stages of the disease. Because of secondary infections, it is often difficult to isolate the guilty microorganism in the later stages of the disease. On the other hand, if you only bring in birds in the early stages of a disease, you may miss an important symptom that would insure proper diagnosis. If you must bring dead birds, be sure they are refrigerated, not frozen. Place the dead bird in a plastic bag, remove the air and keep it in a cool location. Even during fall and spring and especially during summer transportation, place the carcass in an ice chest to insure that it remains cool.

If you prefer to examine your own birds for whatever reasons, there is a specific set of procedures to follow. The following reference book will assist you as you make your observations: Poultry Health Handbook.

External examination

Observe all symptoms of distress to the birds and record them. Take a dead bird and completely wet the carcass. It is easier to examine a bird when the feathers and dander are not flying loose and sticking to your hands. Note the general condition of the carcass. Is it thin or bruised in appearance? Check all external openings such as the mouth, nostrils (nares), ears, and cloaca. Record any findings such as pox marks, lesions, sores, swellings, discoloration, etc. Inspect the bird for signs of external parasites such as mites, lice, ticks, and fleas.

Internal examination (necropsy)

To perform a necropsy you must have heavy scissors to cut through feathers and bone and a small surgical scissor to cut organs; a knife, scalpel and probe are helpful. Wear disposable plastic gloves even though poultry diseases rarely infect humans.

Place the bird on its back and press back on the legs to dislocate the hip joints so the bird lies flat. Begin by examining the head region. Vertically cut through the nasal cavities and check the turbinated bones. The turbinated bone is the membrane-covered plates in the walls of the nasal chamber. Squeeze the turbinate area and observe any liquid or exudate coming from the area.

Place the surgical scissors into the corner of the mouth and cut all the way down the neck. Check for growths, lesions, hemorrhage, and any other bumps. Insert the scissors into the opening of the trachea and cut lengthwise. Examine the inside of the trachea for lesions, blood, bumps, and creamy exudate.

Now examine the abdomen of the bird. Pinch the abdominal skin at the tip of the keel (breast) bone, and cut laterally (horizontally) across the pinched skin. Be

sure not to cut deeply and damage internal organs. Continue to cut the width of the bird. Pull the upper edge of the cut skin and peel it all the way over the breast to the head. Note any abnormalities in the breast muscle.

Using shallow cuts, cut the fat and muscle at the base of the breast. Cut through the ribs to the back with the heavy scissors. Push the breast toward the head and dislocate the shoulder joints. Cut through shoulder joints and remove the breast.

Examine all internal organs beginning with the air sacs. Air sacs normally are clear and shiny. In a diseased state, they can be cloudy and filled with mucus.

Observe the liver for discoloration, lesions, hemorrhagic areas, and swelling. Cut through the liver to check for dead tissue (necrosis), scar tissue, and spots. Follow the same process for the spleen. Examine the heart for swelling and excessive fluid in the sac around the heart. There will be some normal pericardial fluid in this sac. Remove the liver, spleen, and heart after examination to more easily view the digestive tract.

Examine the digestive tract as it lies in the body cavity. Look for signs of hemorrhage, lesions, swellings, and a cheesy exudate. Remove the entire gastrointestinal tract by cutting it at the esophagus and the large intestine close to the cloaca. Beginning at the esophagus, slice lengthwise down the tube, examining each organ as you go along for hemorrhages, lesions, tumors, etc.

Slice open the crop and note any sour smells. Wash the contents and examine the lining for abnormalities. To check for capillary worms, make a small cut and slowly tear the crop wall like a piece of paper. If capillary worms are present, fiber-like extensions will appear as you tear the tissue.

Inspect the proventriculus for blood or a milky lining. Open the gizzard (ventriculus) and determine if the lining has separated. Look for lesions and roughness.

Run the scissors the length of the intestines. Look for small pinpoint hemorrhages, worms, or excessive mucus. If an abnormality exists, record which third of the intestine it is located.

Open the ceca and check for solid, cheesy cores. Wash the contents and examine for blood and worms.

Examine the reproductive tract for swelling or other abnormalities then remove them from the body cavity. Inspect the kidneys and ureters for swelling and small, whitish deposits.

Remove the kidneys and look for a white thread extending towards the leg. This is the sciatic nerve. The brachial nerve extends from the upper portion of the spine and toward the wings. Look for swelling.

Finally, inspect the lungs and bronchial tubes for the presence of excessive mucus, creamy material or blood.

You will find that arriving at a diagnosis may be difficult. Frequently, a bird has multiple infections. Therefore, symptoms and findings from a post-mortem examination will be confusing.

Common Poultry Diseases

Most diseases can be prevented through management practices. However, as every poultry person can tell you, there are times when occurrences seem to be out of your control. If your birds do become sick, you must determine the cause of the illness.

Diseases fall into several categories based on the infecting microorganism and the target organ of the infection. The microorganisms that you typically find are viruses, bacteria, and parasites. Further categorization is based on location such as respiratory diseases, enteric diseases, and nervous system diseases.

Over the history of the poultry industry, great strides have been taken to rid poultry of some devastating diseases. Using genetic selection and rigorous testing procedures, many organisms that previously were rampant among poultry have been abolished or at least controlled. Some of these are Marek's disease, pullorum, and typhoid.

The following list highlights various symptoms and the possible disease(s) associated with them.

Symptom	Disease
Anorexia (loss of appetite)	Endemic Newcastle Disease Avian Influenza Infections Infectious Coryza Aspergillosis Avian Encephalomyelitis Infectious Bursal Disease Duck Virus Hepatitis Duck Virus Enteritis Fowl Cholera Pullorum Fowl Typhoid Staphylococcosis Blue Comb Disease Hemorrhagic Disease Mycotoxicosis Nonspecific Enteritis Round Heart Disease Coccidiosis Histomoniasis Many more nonspecific etiologies
Blue Head	Blue Comb Disease Many bacterial diseases
Chilling	Endemic Newcastle Disease Infectious Bronchitis Pullorum Hexamitiasis

Symptom	Disease
Constricted Pupils	Marek's Disease
Diarrhea	Viscerotropic Velogenic Newcastle Disease Avian Influenza Infectious Coryza Avian Leucosis Complex Infectious Bursal Disease Duck Virus Enteritis Fowl Cholera Pullorum Fowl Typhoid Staphylococcosis Blue Comb Disease Hemorrhagic Disease Nonspecific Enteritis Coccidiosis Histomoniasis Trichomoniasis Hexamitiasis
Discharge from Eyes (Cheesy)	Viscerotropic Velogenic Newcastle Disease Avian Influenza Infectious Coryza Aspergillosis Infectious Laryngotracheitis Infectious Bursal Disease Salmonellosis Fowl Cholera Pox
Discharge from Eyes (Watery)	Endemic Newcastle Disease Infectious Bronchitis Mycoplasma Gallisepticum
Drooling	Trichomoniasis
Drop in Egg Production	Endemic Newcastle Disease Viscerotropic Velogenic Newcastle Disease Infectious Bronchitis Avian Influenza Infectious Coryza Avian Leucosis Complex Avian Encephalomyelitis Duck Virus Hepatitis Blue Comb Disease Mycotoxicosis Nonspecific Enteritis Round Heart Disease Many nonspecific diseases

Symptom	Disease
Droopy Wings	Marek's Disease Duck Virus Enteritis Pullorum Fowl Typhoid Mycotoxicosis Toxicities Tumors Heart Problems
Enlarged Abdomen	Avian Leucosis Complex Omphalitis Peritonitis
Facial Swelling	Viscerotropic Velogenic Newcastle Disease Infectious Coryza
Gasping	Endemic Newcastle Disease Infectious Bronchitis Infectious Coryza Aspergillosis Avian Leucosis Complex Pullorum Infectious Laryngotracheitis Avian Influenza Gape worms (in pheasants & goslings)
Green Feces	Leucocytozoonosis Salmonellosis
Greenish Mouth Fluid	Trichomoniasis
Hyperexcitable	Hysteria in Chickens
Hoarse Chirp	Endemic Newcastle Disease Fowl Cholera Avian Influenza Infectious Laryngotracheitis
Incoordination	Avian Encephalomyelitis Equine Encephalitis in Birds Duck Virus Hepatitis Duck Virus Enteritis Hexamitiasis Marek's Disease
Lesions (on feet)	Mycotoxicosis Ergot Mites Mechanical Trauma
Lesions (on throat)	Fowl Pox

Symptom	Disease
Lesions (warts on head)	Fowl Pox
Listless	Viscerotropic Velogenic Newcastle Disease Fowl Pox Avian Influenza Mycoplasma Gallisepticum Infectious Coryza Aspergillosis Infectious Bursal Disease Inclusion-Body Hepatitis Equine Encephalitis in Birds Duck Virus Hepatitis Duck Virus Enteritis Botulism Omphalitis Fowl Cholera Pullorum Fowl Typhoid Staphylococcosis Blue Comb Disease Hemorrhagic Disease Nonspecific Enteritis Round Heart Disease Coccidiosis Histomoniasis Trichomoniasis Leucocytozoonosis Many nonspecific etiologies
Moist Inflamed Navel	Omphalitis
Molting	Hysteria in Chickens Mycotoxicosis Any Stress
Painful Movement	Staphylococcosis Mycoplasma E. Coli Salmonella
Paralyzed Neck	Botulism
Paralysis	Endemic Newcastle Disease Aspergillosis Avian Encephalomyelitis Equine Encephalitis in Birds Botulism Mycotoxicosis Marek's Disease Raccoon Round Worm Larvae

Symptom	Disease
Regression of Comb	Avian Leucosis Complex Mycotoxicosis Many nonspecific diseases
Skin Tumors	Staphylococcosis Leucosis
Sneezing/Coughing	Mycoplasma Gallisepticum Infectious Coryza Avian Influenza Infection Infectious Laryngotracheitis
Spasms in Feet	Duck Virus Hepatitis
Swollen Foot Pads	Staphylococcosis
Pendulus Crop	Trichomoniasis
Trembling	Endemic Newcastle Disease Equine Encephalitis in Birds Duck Virus Hepatitis
Twisting of Neck	Endemic Newcastle Disease Avian Encephalomyelitis Equine Encephalitis in Birds
Vomiting	Leucocytozoonosis
Watery Egg Whites	Infectious Bronchitis

National Poultry Improvement Plan

The National Poultry Improvement Plan (NPIP) was initiated in 1940 to control Salmonella pullorum in poultry flocks. This organism produces a sometimes deadly disease in chickens commonly called pullorum or bacillary white diarrhea. This disease is highly fatal to young chicks; if they do recover from the disease, they remain carriers of the organism and can transmit it to other poultry.

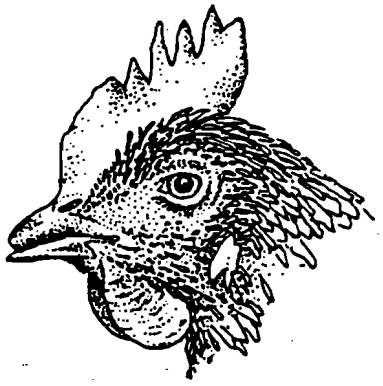
There are more than two thousand species or serotypes of Salmonella bacteria. Generally, the digestive system is primarily affected so these organisms are referred to as enteric organisms. The particular species, pullorum, is not a health danger to humans.

Pullorum is primarily transmitted from hen to egg but also spread by other means. It can be spread by infected incubators, hatchers, chick boxes, contaminated houses and equipment, carrier birds, and poultry by-product used as feedstuffs.

Pullorum is highly fatal to young chicks or poults, but mature birds are more resistant. Young birds may die so soon after hatching that no signs are observed. Most acute outbreaks occur in birds under three weeks of age. Mortality in such outbreaks may approach 90 percent if untreated. Survivors usually are stunted or unthrifty. Infection in young birds may be indicated by droopiness, ruffled feathers, a chilled appearance with birds huddled around the source of heat, white diarrhea with "pasted" down around the vent, and labored breathing.

Treatment of pullorum is available for flock salvage only. Several sulfonamides, antibiotics, and antibacterials are effective in reducing mortality, but none eradicates the disease from the flock. Eradication requires elimination of reactor birds and in some cases entire flocks, decontamination of premises, and restocking with pullorum-free poultry. Recovered birds are carriers and should not be saved for breeder replacement. The organism is resistant to cold, sunlight, drying, and disinfectants. The incubation period in birds is four to five days; however, the bacterium will live up to one year in a chicken house.

Almost every state participates in the NPIP program. The efforts have proved quite fruitful in insuring that poultry buyers will obtain good, healthy stock. If you would like to understand more about the NPIP, write to the United States Department of Agriculture for a brochure.



Control Of Rodents

Rats make up the largest group of mammals on earth, about one-third of the total mammalian population. A single rat can consume or ruin 40-50 pounds of feed per year.

Rats breed at three to four months of age and probably continue until about eighteen months old. Gestation is twenty-one to twenty-five days. The young are weaned at three weeks old, often just before the arrival of another litter. A female can breed as early as one day after giving birth. If fertilization does not occur, she will come into heat about every five days. A female averages six litters per year, with nine young per litter. However, under ideal conditions, litters may contain as many as twenty young, and as many as fourteen litters have been recorded. The babies from one pair of rats would number more than 3.5 million in three years under ideal conditions and ignoring the death rate. In natural conditions however, many die, but in a year six to seventy offspring from one female may mature. Breeding is greatest in spring and fall, drops slightly in the summer, and drops substantially in winter.

Reproduction of the house mouse is similar to rat's. The average gestation is twenty days and litter size is about six, with six to ten litters per breeding life of the female.

Rats are known to spread twenty-five diseases to humans and animals. Some human diseases rats spread are Salmonellosis, rabies, tularemia, leptospirosis, amoebic dysentery, typhus, jaundice, trichinosis, rickettsialpox, lymphocytic choriomeningitis, ray fungus, and ringworm. Also, they transport and host ectoparasites, especially mites.

When you remove poultry at the end of a production cycle or week, rats tend to migrate to other places where they can get feed and water. However, if feed is left in the feeders or spilled around feed bins and water remains available in the house or at a source nearby, most of the rats will not move elsewhere. But it is believed many rats do migrate between poultry farms during cleanout or down time, perhaps spreading poultry diseases and ectoparasites as they travel. Since rats usually feed directly in the feed trough and drink from the chickens' waterer, they provide an ideal means of transporting diseases from farm to farm.

You can estimate your rat and mouse population. If you never see rats but see signs of them, up to one hundred may be on the premises. If you see them occasionally at night, there are one hundred to five hundred. Occasional daytime and numerous night sightings indicate four hundred to a thousand. Seeing several in the daytime may indicate as many as five thousand. When one farmer sold his laying flock he decided to get rid of the few rats in his hen house. The score at the end of his extermination program was 1,800 dead rats.

Do not assume that you do not have rodents. Look for signs. Examine the area for burrows, tracks, droppings or urine, gnawing, rubbing or clawing marks, nests and food caches, hysteria and excitement of the flock, and damaged insulation and curtains. To decrease the likelihood of getting rats, periodically clean the feeders and feed storage bins to insure that a buildup of feed does not encourage rodent traffic. Mow grass and weeds around the house. Try to block openings to the house or feed room. But remember, rodents can get through a 1/2 inch opening. Rats tend to migrate twice yearly so take advantage. In the summer months, they live in the field and travel to the farms at night to feed. In the winter, there is a mass migration to the poultry farm for housing. This travel often occurs along stream beds or run-off areas.

Once you know that you do have rodents and they are literally eating away your profits, there is action you can take. The following is a list of your options.

1. **Poison** - Remove all unpoisoned feedstuffs. Place many small baits around your facility out of reach of your chickens. Do this on a large scale, preferably during the biannual migration. Initially, place unpoisoned feed in boxes until they get used to it. One disadvantage to this method is the smell of dead carcasses. Thus, place the bait in the migration paths. To take extra precautions, add the poison to grains or mash and place it out of the way of pets to prevent them from consuming it.

2. **Gassing** - Make burrows escape-proof except for one opening. Utilize a dusting pump or similar item to deliver the poison. Protect yourself and any other living animal from the poisonous gas. Apply the gas and wait outside by the opening with a club. Have another person help to club those that attempt to escape.

3. **Blocking** - Close all but one or two rat holes in a building or room, including windows and doors. Let the rats get used to this arrangement. Construct a hanging sandbag or something to block off the remaining opening. Place a few boards a few inches off of the floor to allow more killing time. A few hours after dark, enter the room with clubs. Tighten your trouser legs at the ankles or tuck them into your boots. Let the sandbag down and start swinging.

4. **Trapping** - You must use many traps, not just one. Rats become very wary, so you must do most of the work on the first night. This is useful only as maintenance. Place the traps along walkways, against walls, on pipes, etc. Camouflage the traps with feathers, dust, coal ashes or whatever is prevalent in your facility.

5. **Other** - Other methods include smoking, drowning, or anything else that you have found successful. As a preventive practice, when building new facilities, use a 1/2 inch mesh hardware cloth in the corners and where pipes are laid. Elevate the house one foot off the ground. Make a rat hole with a trap inside.

Parasite Control

External Parasites

Mites and lice are the most common external parasites found on chickens. Many times these parasites are brought into the chicken house by wild birds, equipment, paper material such as egg flats, and animals. Insecticides, such as malathion, Co-Ral, and Rabon, are effective in controlling mites and lice. Consult the **Agricultural Chemicals Handbook** or your local County Extension Office for instructions on proper use of these materials. **Follow instructions;** insecticides can be extremely dangerous when improperly used! Use only insecticides that are cleared for use on or around poultry. **Read the label.**

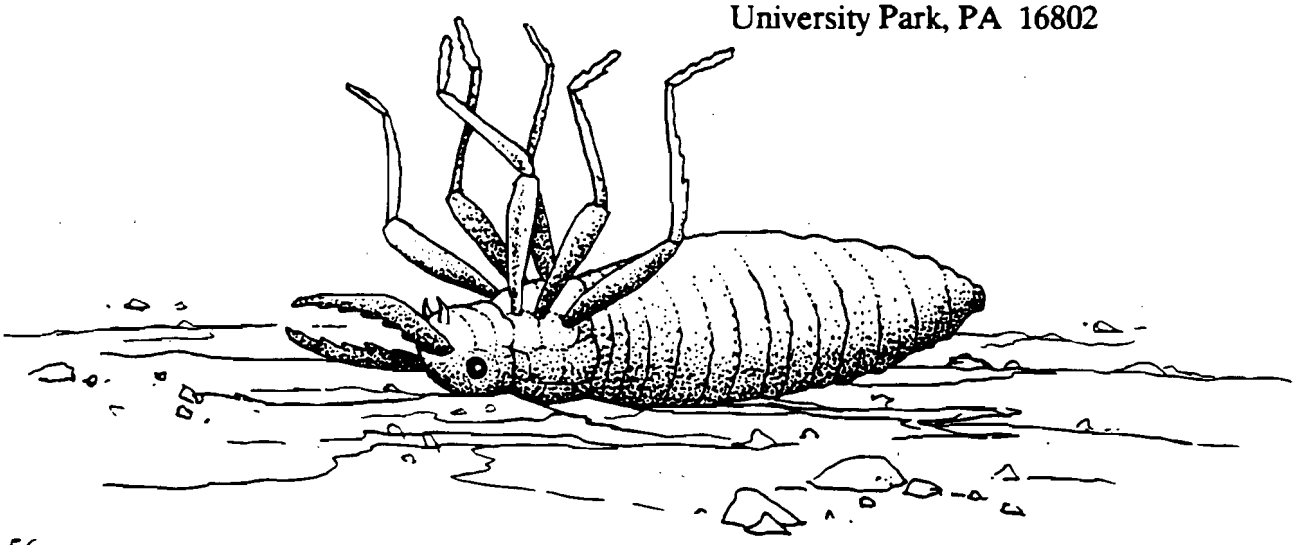
Internal Parasites

The primary internal parasites of poultry are roundworms, cecal worms, capillary worms, gapeworm, and flukes. Good sanitation and management practices will prevent and control worms. For treatment, use a worming compound recommended for the specific worm involved or a combination wormer for multiple worm infections or where the worm involved is not known.

Broilers can be treated every two weeks if necessary, starting the fourth week of age. For layer replacement stock, worm at eight weeks of age and once per month thereafter if necessary.

References

- National Poultry Improvement Plan APHIS-VS, Rm. 771 FB, Hyattsville, MD 20782
- Poultry Health Handbook, third edition, by L. D. Schwartz, $12/copy (shipping included). Order from: Agricultural Publications Distribution Center, Pennsylvania State University, 112 Ag Administration Building, University Park, PA 16802



Chapter 9

ARTIFICIAL INCUBATION

Selection And Care Of Hatching Eggs

Obtaining Hatching Eggs

Contact your local county Cooperative Extension office to find sources of fertile eggs. When you have located a source, pick them up yourself if possible rather than having them shipped or mailed. It is difficult for hatcheries, the postal service, or transportation companies to properly handle a small order of eggs.

Care of Eggs Before Incubation

Care of fertile eggs prior to incubation is as critical to a good hatch as the incubation period itself. The optimal short-term storage environment is 65°F and 75-80% relative humidity. Be careful not to freeze the eggs or to let the egg temperature fall below 45°F, as this will weaken the embryo. A basement or cellar is usually a good storage depot. Refrigerators, especially the frost-free variety, are too dry for egg storage, although some people have had success when the eggs are placed in a zip-lock bag with damp paper towels. However, this is definitely not the method of choice. An ice-chest is another good option; the temperature will be cool and the melting ice will add humidity to the environment. Be sure to keep the eggs out of the water as this will spread germs that will kill the embryos. Remember, eggs that are exposed to temperatures of 75°F will begin embryonic growth. Cooling the egg before actual incubation weakens the embryo and decreases the chance for hatching.

The length of storage time is also a critical factor. Hatchability of chicken eggs decreases each day the eggs are held. Hatchability is reduced to 79% when fertile eggs are stored for seven days. After ten days, hatchability is decreased to only 68%. Hatching time is prolonged nearly two additional days when eggs are stored seven days and more than three additional days when stored for ten days. Remember, these figures are representative only of eggs stored in the optimum environment.

When transferring eggs from storage to the incubator, you must let them warm slowly. Placing the eggs at room temperature for 6-8 hours reduces the condensation which

forms on the egg when exposed to a large temperature gradient. It is good to avoid formation of moisture because it provides good conditions for bacterial growth.

The condition of the egg is important to the hatchability. Misshapen, dirty, ridged, spotted, or cracked eggs are less likely to hatch than a good, sound egg. Defective eggs should not be set because there is a greater chance of internal contamination by bacteria and the creation of an "exploder" egg which would contaminate all the eggs in the incubator.

Incubating The Eggs

Incubation means maintaining conditions favorable for developing and hatching fertile eggs. Still-air incubators do not provide mechanical air circulation. Circulating-air incubators are equipped with electric fans. Optimum operating temperatures differ slightly, so follow the manufacturer's optimal operation instructions.

The factors of critical importance in incubating eggs artificially are: temperature, humidity, ventilation, turning, and condition of egg.

Temperature

Still-air incubators should be operated in a location free from drafts and direct sunlight. Place them in an area with the least temperature fluctuation. Incubators must be turned on and the temperature and humidity allowed to reach the desired levels the day before the eggs are set. This insures that the incubator is working properly and that the eggs have the optimal environment for embryonic development. During the warmup period, the temperature should be a constant 100°F. To obtain reliable readings, the bulb of the thermometer should be at the same height as the top of the eggs and away from the source of heat.

Incubator temperature should be maintained at approximately 99°F. The acceptable range is 97-103°F. If the temperature stays at either extreme for several days, the hatch may not be as good as expected. (See figure 1.) Overheating is more detrimental than underheating. Running the incubator at 105°F for thirty minutes will seriously impair embryonic development, but running it at 90°F for three or four hours will only slow their metabolic rate and delay the hatch.

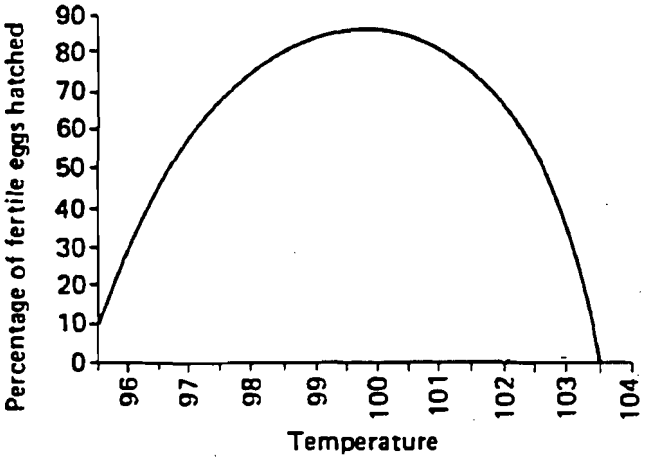


Fig. 1. The effect of incubation temperature on percentage of fertile eggs hatched. Relative humidity 60 percent, carbon dioxide below 0.5 percent.

An incubator that runs a bit warm, averaging slightly above 99°F, produces an early hatch. An incubator averaging slightly below 99°F results in a late hatch. It is important to check your thermometer for accuracy. The best way to do this is to use two thermometers. If different readings are taken from each thermometer, then one of them is wrong! Obtain another thermometer. Place all three in the incubator. After several hours, check the readings. Hopefully, only one thermometer will be different than the others. Throw the defective thermometer away immediately.

Humidity

The relative humidity within an incubator for the first eighteen days should be about 60 percent. During the last three days (the hatching period) the relative humidity should be nearer 70 percent. (See figure 2.) Too little moisture in the incubator results in excessive evaporation from the egg, causing chicks to stick to the shell at hatching time or to die in the shell.

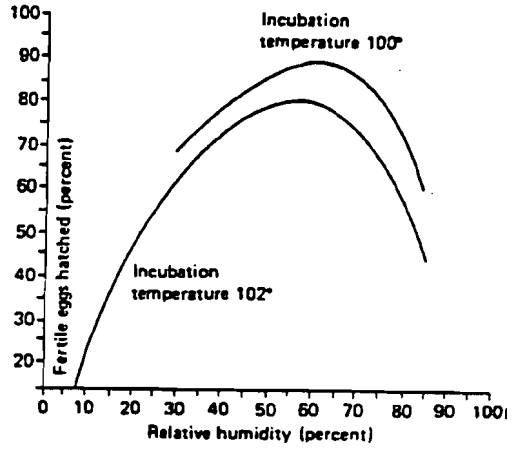


Fig. 2. The effect of relative humidity at two different incubation temperatures on percentage of fertile eggs hatched.

The table below will enable you to calculate relative humidity using a wet bulb and the incubator thermometer readings.

Rapid loss of moisture (humidity) occurs every time the incubator is opened. To offset this loss during the hatching period (the final three days), the humidity in the incubator may be increased by using an atomizer to spray a small amount of water into the ventilating holes. This is especially helpful when duck or goose eggs are being hatched.

Pans of water placed under the egg tray provide adequate moisture. The relative humidity in the incubator can be varied by changing the size of the water pan or by putting a sponge in the pan to increase the evaporative surface. The pan should be checked regularly while the incubator is in use to be sure that there is always enough water. Keep the water in the pans clean! Bacterial or mold growth can impair the growth of the embryo.

In the latter stages of incubation (from the nineteenth day on), a small amount of con-

Table 1. Relative Humidity

Incubator Temperature	Wet-bulb thermometer readings					
99.5° F	81.5	83.1	85.1	86.1	88.7	90.5
100° F	81.3	83.3	85.3	87.3	89.0	90.7
101° F	82.2	84.2	86.2	88.2	90.0	91.7
102° F	83.0	85.0	87.0	89.0	91.0	92.7
Relative humidity (%)	45.0	50.0	55.0	60.0	65.0	70.0

densation on the glass indicates the presence of sufficient moisture. The condensation is also related to the temperature of the room where the incubator is being operated, however. There will be more condensation on the glass if the room is cold, so be sure the temperature in the incubator remains steady at 99°F.

It is also possible to determine whether there is too much or too little humidity in the incubator by candling the eggs and comparing the size of the air cell with the diagram in figure 3. The air cell will be too large if the humidity is low. Too much humidity results in a smaller than normal air cell.

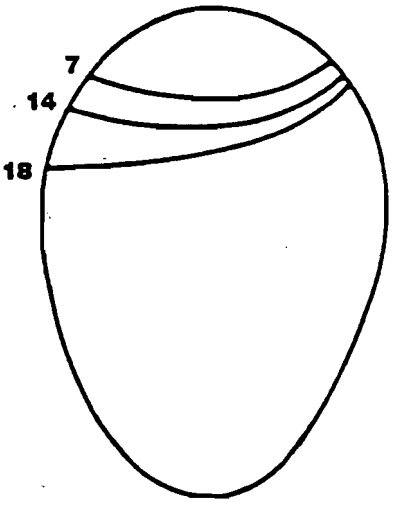


Fig. 3. The air cell on the 7th, 14th, and 18th days of incubation.

Ventilation

The best hatching results are obtained with normal atmospheric air, which usually contains 21 percent oxygen. It is difficult to provide too much oxygen, but a deficiency is possible. Make sure that the ventilation holes are open to allow a normal exchange of air.

Turning

Turning the eggs during the incubation period prevents the blastoderm from migrating through the albumen and sticking to the shell membrane. The eggs should be turned three to five times daily from the first to the eighteenth day. Wash your hands before and after this step. The pores in the egg shell that allow respiration will also absorb any microbes or dirt from your hands.

One way to help you keep track of how the eggs have been turned is to mark one side of each egg with a pencil. Do not use a pen; the ink may be absorbed into the egg. Another option is to write on the egg the date it was placed in the incubator. This helps keep track of the expected date of hatch.

Place the eggs on the welded wire platform in a single layer with the dates on top. When the eggs are turned, the dates will be on the bottom or out of sight. At the next turning, the dates will be in view, and so on.

After the eighteenth day, do not open or move the incubator until the hatch is completed because the chicks are assuming the hatching position and humidity must be maintained.

Hatching Period

The hatching period is the final three days of incubation. During this time, the eggs should not be turned. You should place a clean cloth under the eggs at this time to protect the new-born chicks' navels from injury. The navel is the place where the abdomen closed after surrounding the remains of the yolk.

Allow the newly hatched chicks to dry out in the incubator. Once they have begun to fluff up, transfer them to a brooding unit.

Sanitation of Incubator Equipment

After the hatch has been completed, the incubator box and tray should be brushed clean of all debris and dust. The cleaned surfaces should be wiped thoroughly with a cloth dampened in a quaternary ammonium germicide, Clorox, or other disinfectant. Follow the directions of the manufacturer.

Incubation Records

Near the incubator, post a chart on which records can be kept. The person who turns the eggs can observe and record other information to help keep track of the incubation and hatching schedule. Keeping good, accurate records is a critical component. The existence of data will help you make decisions concerning the reasons for obtaining a good or bad hatch.

Table 2. LOCATING INCUBATOR PROBLEMS

SYMPTOM	PROBABLE CAUSE
Chicks hatching too early, with bloody navels.	Incubator temperature is too high.
Draggy hatch: some chicks early but slow in finishing.	Temperature too high.
Delayed hatch; eggs not pipping until 21st day or later.	Temperature in incubator is too low.
Short down on chicks.	High temperature or low humidity.
Mushy chicks. Dead on platform. Bad odor.	Navel infection caused by bacteria in incubator.
Chicks too small.	Low humidity or high temperatures.
Shell sticking to chicks.	Low humidity at hatching time.
Chicks smeared with egg contents.	Low average temperature. Humidity may be too high.
Eggs pipped but not completing hatch.	Low humidity or dead in shell the last two days or high humidity (unlikely).
Crippled chicks: missing eye, cross beak, extra leg, etc.	Mostly chance. Poor nutrition of parent stock. Heredity.
Rough navels.	High temperature or low humidity.

Incubation Record

Day	Time eggs are turned	Room temperature	Incubator temperature	Number of infertile or dead embryos [1]	Remarks (who turned eggs, etc.)
1	X				
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19	X				
20	X				
21	X				

Summary:

Number of eggs set	Number fertile	Percent fertile	Number hatched	Percent hatched

[1] Must candle to determine.

Incubation Periods Of Other Species

One of the miracles of nature is the transformation of the egg into the chick. In a brief three weeks of incubation, a fully developed chick grows from a single cell and emerges from a seemingly lifeless egg.

Not all avian eggs hatch in twenty-one days. The Japanese quail needs 17 days; the pigeon 18 to 20 days. The swan and the ostrich need 42 days of incubation before hatching. The duckbill platypus is the only mammal that lays eggs, and they have an incubation period of 12 days.

The following chart shows comparative incubation information for 13 domestic birds:

Bird	Incubation Period (days)
Chicken & bantam	21
Turkey	28
Duck	28
Muscovey duck	35-37
Goose	28-34
Guinea	28
Pheasant	23-28
Peafowl	28-30
Bobwhite quail	23-24
Coturnix quail	17
Chukar partridge	23-24
Grouse	25
Pigeon	13

Observing The Developing Embryo

Candling the Developing Eggs

Candling eggs is an excellent method for determining the progression of the developing embryo. It is a simple technique to see inside an egg without destroying the contents. The method uses of a strong light in a darkened room to illuminate the outline of the interior egg.

Candling is important for a successful hatch. Routine candling helps you to detect, then remove, any embryos which have died. Dead embryos in the incubator serve as a source of contamination. Since the egg contains rich and appropriate nutrients, it provides an excellent media for microbial development. Always candle and remove dead embryos to facilitate optimal hatchability.

There are many ways to construct a candler. Let your imagination take over. A slide projector with the lens removed will suffice. Simply place a piece of cardboard with an opening over the hole. A flashlight in a tin can or an oatmeal box will also serve as a candler.

The following instructions will help you construct a shoe box-sized candler. You may be able to obtain these candlers from a 4-H member.

Constructing a Candler

- 60-watt bulb.
- Male electric plug.
- Porcelain socket
- No. 8 round-head screws--1" long.
- Seven-penny, coated box nails.
- Small brads.
- Piece of lumber - 1" x 6" x 38".
- Six feet of electrical cord.
- Piece of 1/4-inch plywood--6 3/8" square.

Step 1. Cut four pieces, each 8 inches long, from the 1" x 6" x 38" board.

Step 2. Drill a 1-inch hole in one of the pieces, as shown. Bevel the edge of the hole.

Step 3. Nail the four 8-inch pieces together. Cut the remaining piece to fit inside the candling box as a bottom.

Step 4. Before nailing this bottom into place, fasten the porcelain socket to the center of the piece with screws.

Step 5. Drill a 1/4-inch hole in the back of the candler for the electric cord.

Step 6. Wire the electric cord to the socket and nail the bottom in place.

Step 7. Feed the cord out through the hole, and wire it to the male plug.

Step 8. Nail two small strips of wood to the plywood square. This piece will serve as a removable top, and will be held in place by the strips.

(See figure 4 on next page.)

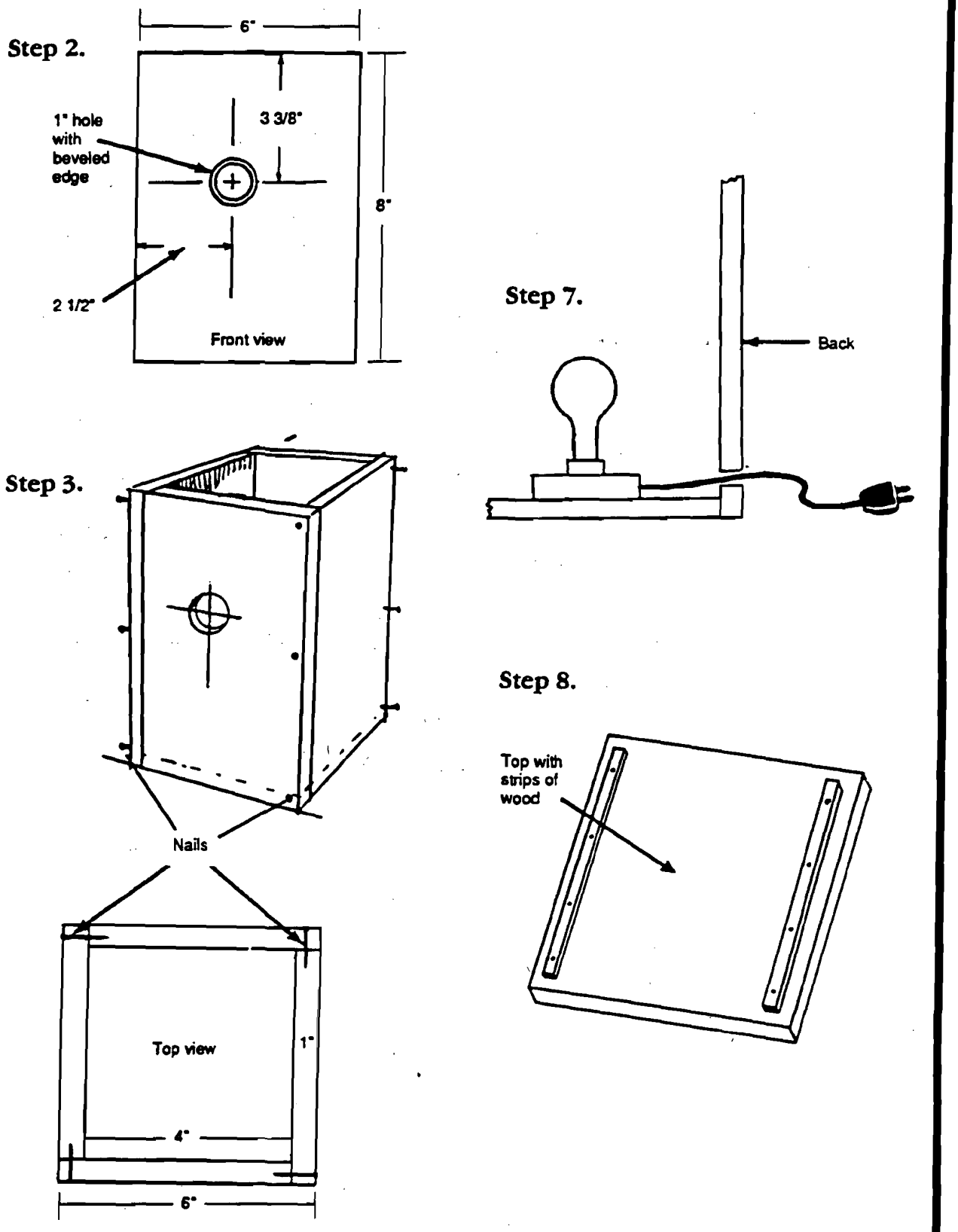


Fig. 12. Constructing a candler

Fig. 4. Constructing a candler

Materials Needed for Candling Eggs

- Fertile eggs
- Candler
- Egg carton--to hold eggs while they are being tested

Step 1. Remove the eggs from the incubator and place them in the egg carton in front of the candler.

Step 2. Darken the room, if necessary, so that the strongest light is coming from the hole in the candler.

Step 3. Hold the egg in front of the hole in the candler with the broad end at a 45-degree angle to the light. (See figure 10.)

Candling eggs that have been incubated for 3, 6, 11, 14, 18, 19, and 20 days is an excellent way to observe embryo development. A comparison with a table egg will show what an unincubated, infertile egg looks like. As you rotate the fertilized egg slowly from left to right in the light of the candler, you will observe one of the following conditions:

Live Embryo. Figure 11 shows the changes in a developing embryo and suggests how the embryo mass grows. The 18-day old incubated egg is entirely opaque except for the large air cell in the broad end and a small space in the narrow end. At approximately four days, a network of blood vessels will be readily detected when the egg is candled.

Dead Embryo. The egg may or may not be filled with the dead embryo, depending on its age at death, but the mass will cease to grow. There may be evidence of a blood ring or a bloody area in the younger embryos that die. (See figure 12.)

Infertile Egg. The egg is clear, except for a yolk shadow. At times, the egg may actually have been fertile, but death occurred early. You can break out the egg to determine if it was a true infertile.

After testing the eggs, segregate the live embryos and put them back into the incubator. Destroy the infertile eggs and those with dead embryos.

TIPS FOR A SUCCESSFUL HATCH

1. Use eggs that have been correctly stored for less than seven days.

2. Use a clean incubator that has been set up (temperature and humidity maintained) for at least twenty-four hours prior to setting the eggs.

3. Check temperature and humidity as often as possible.

4. Turn the eggs at least three times daily for the first eighteen days.

5. Add water as needed.

6. Place the incubator away from drafts and sunlight.

7. Candle eggs every three days to determine mortality and infertiles. Remove those eggs not carrying live embryos.

Chapter 10

BREEDING AND GENETICS

Breeding

Breeding is a fun and rewarding experience for those who raise poultry. The following information will help you understand the genetics behind the practical breeding operation.

Sexual maturity

Birds must be sexually mature before breeding can take place. Maturity occurs at approximately 5 months of age. Heavy breeds mature slightly later and light breeds slightly earlier than the average. Bantams mature at more various times depending on the breed. Females come into production (lay eggs) about 2 weeks before the males produce viable sperm, so keep this in mind when beginning the breeding season.

Lighting greatly affects maturation and reproduction. A bird must have a minimum of 12 hours of light to lay eggs or produce viable sperm. However, in a breeding situation it is optimal to provide 14 hours of light. Therefore, if you only want your birds to breed through the spring and summer, no extra lighting is required. But if you want breeding to occur throughout the year your birds must be lighted (provided with at least 14 hours of light per day).

Mating

Chickens do not mate in pairs. As a matter of fact you may use one rooster for every ten hens of a heavy type (ie, American class) and for every fifteen hens of a light type (ie, Mediterranean class). The mating ritual itself is very fast, taking only a few seconds. If you fail to see the mating, you may see evidence of it by the lack of feathers on the back and "bite" marks on the comb of the hens.

Sex Identification

It is difficult to determine the sex of a chicken. A day-old chick may be vent-sexed but this is a difficult procedure that is not practical for a home flock. You may also produce chicks that can be sexed by feather length or color of the down. Actual examples of this will be provided later.

Since most breeders do not use the procedures mentioned above, sex determination by secondary sexual characteristics is used. Secondary sexual characteristics are those characteristics of the chicken that are produced by the sex hormones and can be detected once the birds are between 7 and 20 weeks of age. Examples of these are size, crowing, pointed hackle feathers in the male and rounded ones in the female (except in the Sebright bantam), and long tail feathers in the male. The size of the comb can be tricky. Female Leghorns, have such large combs that beginners often mistake a hen for a cock. Also, combs vary in size according to the breed. For instance, the single comb of the Leghorn is far larger than that of the Plymouth Rock.

Breeding Program

There are two general methods of maintaining a breeding operation. Each has advantages and disadvatages that must be assessed by the individual breeder.

Mass selection is the simplest and more often used with production-type birds. The birds are housed in floor pens with the ratio of males to females as mentioned above. Random mating takes place and you evaluate the offspring for certain qualities.

Progeny testing is the selective mating of individuals whose pedigrees are known. In this situation, you know more about the individual traits of your breeding birds and their ancestors. You will know if your bird has any defects in its background that might show up in the offspring.

When establishing a breeding operation, there are several strategies to take. Crossbreeding, line breeding and inbreeding are described below. With time these will become individualized to your situation.

Crossbreeding

A chicken breed is a group of birds related by common ancestors and is so designated by the American Poultry Association or other similar group. Breed members produce offspring that carry the distinguishing features of that group. Birds of one breed are more closely related than are birds of another breed.

Crossbreeding is the mating of birds from different breeds or strains. One example of crossbreeding is as follows:

Plymouth Rock x Cornish = Hybrid

This method of breeding in modern meat bird production is used because it can result in offspring that perform better than either parent. The reasons for better perfor-

mance are not well understood. Although the offspring from crossbreed matings may be of high quality, these birds are never used as breeders. They will not breed true because they contain genetic material from two different breeds. To obtain the benefits of crossbreeding, each generation must be produced by parents of different breeds.

Inbreeding

Inbreeding involves pairing closely related individuals. It is a category that includes pairings of birds from the same generation, as well as pairings with a generation gap. Several examples are as follows:

SAME GENERATION: Brother x Sister or 1st Cousin x 1st Cousin

GENERATION GAP: Father x Daughter or Grandmother x Grandson

Pairings with a generation gap are also known as line breeding. Line breeding and inbreeding are often used as synonyms; however, these terms are not interchangeable! It is easiest to think of line breeding as a form of inbreeding. Inbreeding is not necessarily line breeding.

Inbreeding can transfer desirable as well as undesirable traits in a flock. Improvement of a flock depends on good record keeping, careful pairings, and well-considered culling.

Line Breeding

Line breeding is a specialized form of inbreeding. It involves mating relatives in an ancestor-descendant relationship. The following are examples of line breeding matings:

ANCESTOR	X	DESCENDANT
Father	X	Daughter
Mother	X	Son
Grandfather	X	Granddaughter
Grandmother	X	Grandson

Line breeding is a selective form of breeding which may preserve the most desired characteristics of the best birds. It may also preserve undesirable traits. It is important to cull birds with major faults or weaknesses so that these traits are not continued.

Neat, organized records make line breeding easier. This form of breeding may be an advantage to breeders with small flocks or when breeders are pressed for mating combinations.

Keeping Records

Good record keeping is important for a successful breeding program. Breeding records show the productivity of a hen and cock, and if the mating is producing desirable offspring. The breeding record chart should contain the following information: nest number, bird numbers and description of parents, date eggs were laid, date eggs hatch, bird numbers of each young, sex, color description, and any comments on the birds as they mature.

Pedigree Records

Pedigree records are also important because they show the bird's ancestors. These records help the breeder to make decisions about the best breeding method to use (i.e., inbreeding, line breeding, outcross, etc.). They also help the breeder decide which birds to pair. In addition to ancestry, the pedigree should include the following: bird number, sex, description, exhibition record, and any further comments on the bird.

BREEDING RECORD CHART					
YEAR			CAGE NO.		
COCK			Class, breed, variety		
HEN			Class, breed, variety		
EGG NO.	DATE LAID	DATE HATCHED	CLASS, BREED, VARIETY	SEX	REMARKS

PEDIGREE RECORD CHART		
Bird No.	**Sex**	**Date Hatched**
Class, Breed, Variety		
Exhibition Record		
Date	**Exhibition**	**Award/Comments**
Remarks:		
Parents:		
Hen	**Cock**	
Bird No.	**Bird No.**	
Class, Breed, Variety	**Class, Breed, Variety**	
Remarks	**Remarks**	
Grandparents:		
Hen **Cock**	**Hen** **Cock**	
Bird No. **Bird No.**	**Bird No.** **Bird No.**	
Class, Breed, Variety	**Class, Breed, Variety**	
Remarks	**Remarks**	

Anatomy Of The Chicken

Before you can become familiar with genetics and develop a good breeding program, you must have knowledge about the anatomy of the chicken. For further information contact your Cooperative Extension service.

Genetics

Chromosomes are thread-like structures made of DNA that carry genes. Genes are the units of inheritance. There is a gene for feather color, comb type, and every other characteristic. Some characteristics have more than one gene and some genes are expressed differently when another gene is present.

Chickens have thirty-nine chromosome pairs. Every species has a unique number so that, when breeding occurs, the chromosomes from the parents can be evenly matched. Each chromosome recognizes its correct counterpart when pairing up. When two different species are mated, the resultant offspring are sterile because all chromosomes do not have a matching pair. This leads to improper gonadal development. Examples of this are a cross between a horse and a donkey or a Pekin duck and a Muscovey.

During sexual reproduction, each parent passes a duplication of half of its chromosomes to its offspring. Since the offspring receive one-half of their inheritance from one parent and one-half from the other, they receive two genes for a single trait. These two genes always pair up, just as the correct chromosomes always pair up.

One of the thirty-nine chromosome pairs is responsible for determining the sex of the offspring. In poultry, the female carries the sex chromosome and as a result, determines the sex of the offspring. The opposite is true in humans where the male carries the sex chromosome and so determines the sex of the offspring.

Simple Inheritance

If you cross a bird with a rose comb (ie, pure-bred Brahma) with a bird with a single comb (ie, pure-bred Leghorn), you always get offspring with a rose comb. When you cross a black Leghorn with a white Leghorn, the offspring are white. These are examples of simple dominant and recessive traits. Since the offspring receive two genes for each trait, then one of the gene pairs must dominate over the other recessive gene and produce offspring that look like the dominant gene.

Capital letters are always assigned to dominant genes and small letters to recessive genes. Na stands for the naked neck gene and na stands for the feathered neck gene. So, when a naked neck chicken is crossed with a feathered neck chicken, the offspring will be naked necks.

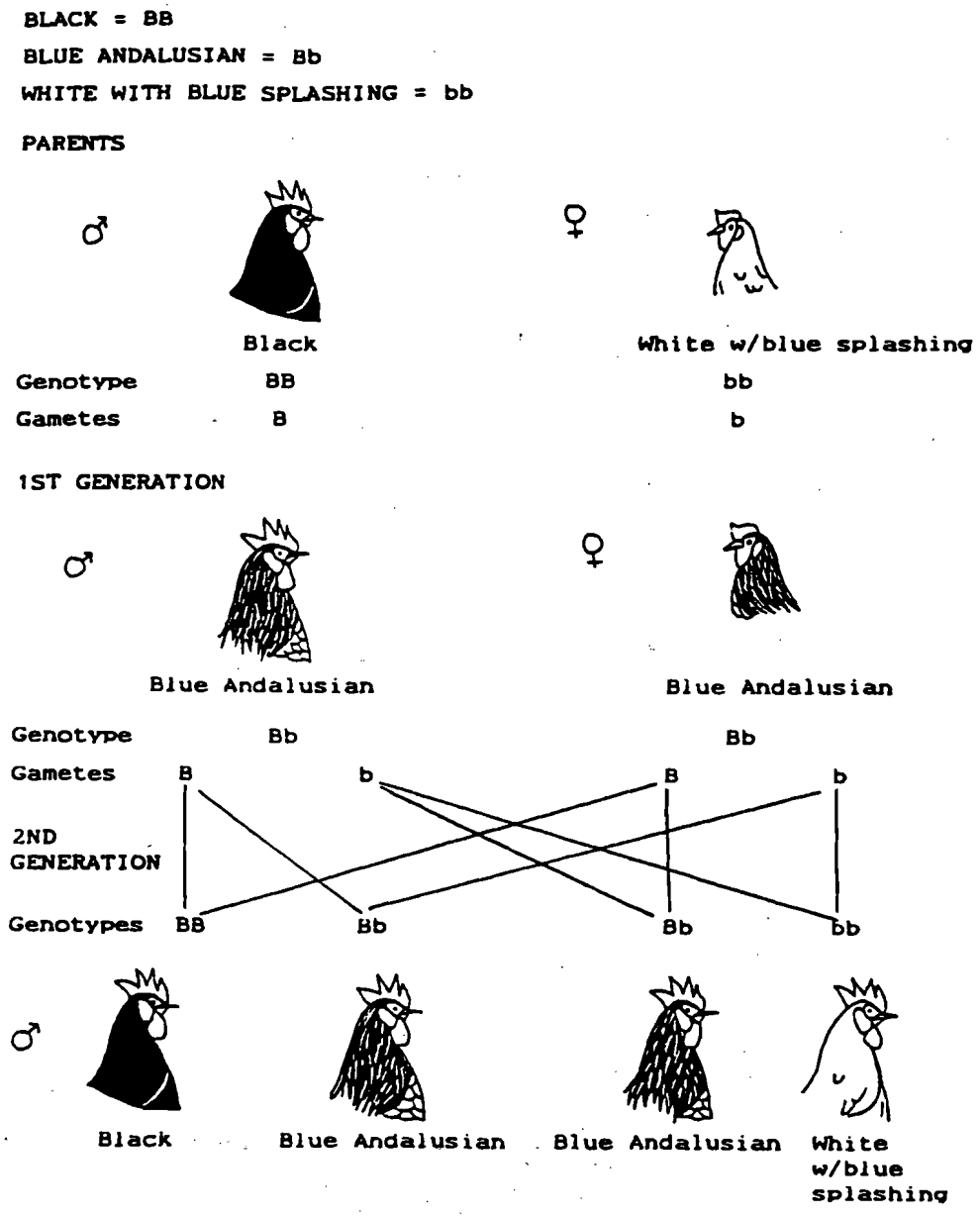
Birds with two genes that are alike (both dominant or both recessive) are called homozygotes (ie, Na/Na or na/na). "Homo" means the same and "zygote" is the cell after

Fig. 1. Individual members of chromosome pairs cannot be identified beyond the tenth pair because of the small size and similar appearance of these chromosomes.

fertilization takes place. Heterozygote refers to the bird with a mixed pair of genes (one dominant and one recessive. ie, Na/na).

Not all genes follow the rules of simple inheritance. Some genes are incompletely dominant or will be dominant only in some breeds if other genes are present. Other dominant genes are diluted in the presence of the recessive partner. An example of this is the Blue Andalusian. The letter B stands for this trait. In order to see a blue color, you must have a heterozygous bird (Bb). A bird with BB looks black and those with bb look white with blue splashing. Therefore, if you mate two Blue Andalusians you will not produce all blue offspring. See figure 2.

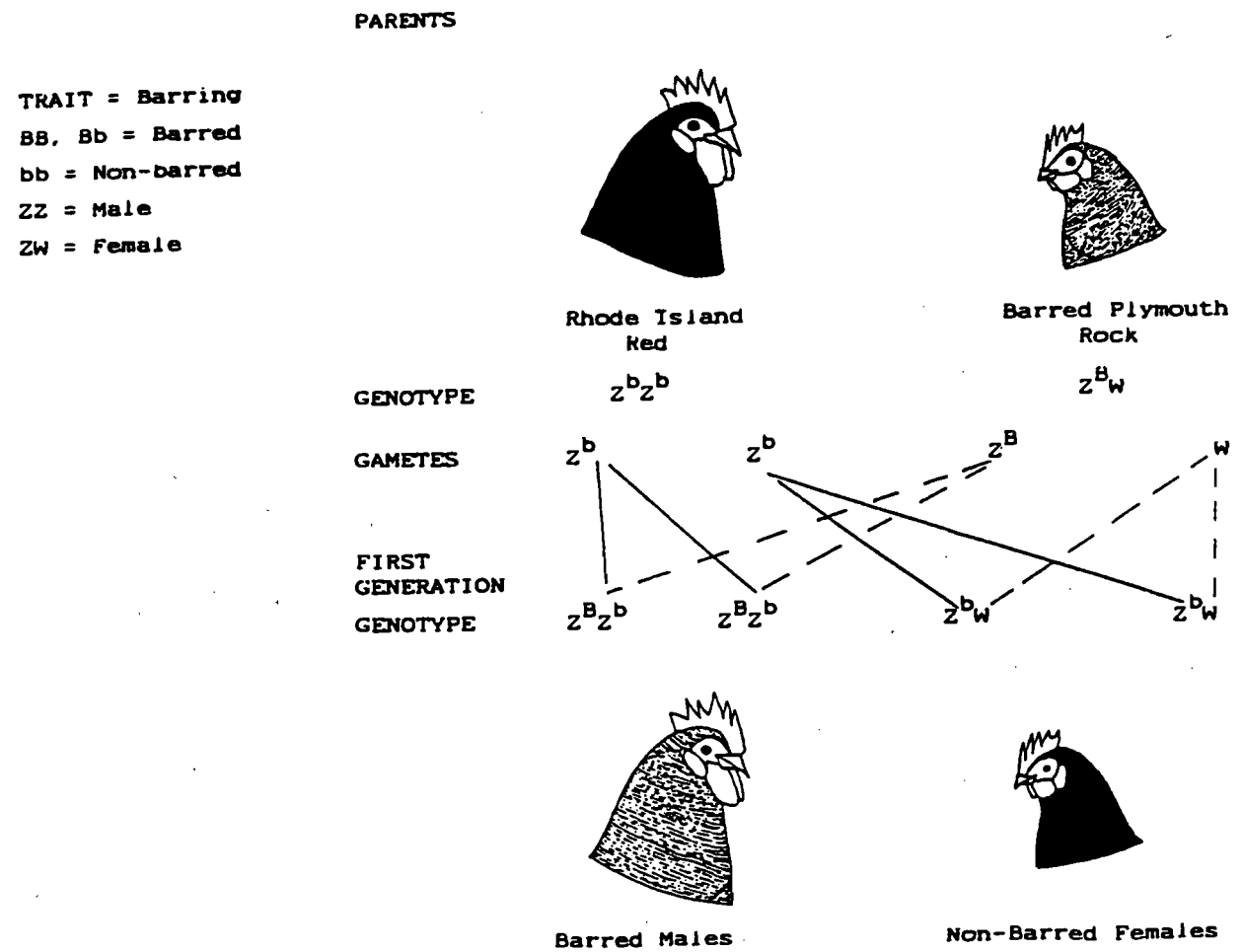
Fig. 2. Incomplete Dominance



Sex-linked Traits

Some genes are located on the sex chromosomes. The male's sex chromosomes are called ZZ and the female, WZ. Since the W chromosome probably cannot carry any other genes except that for sex, the female can only have one gene for a given trait. Examples of this are barring, feather growth, and gold and silver color. See figure 3 below.

Fig. 3. Sex-linked Barring



Exhibiting Your Birds

A good way to learn more about chickens is to attend a local poultry show. At a show you will find breeders who have raised poultry for many years and are thus excellent sources of information. By attending and exhibiting, you are able to see various breeds, learn how they are judged, talk to the owners about the do's and don'ts of breeding, and have your own birds' quality judged. Since you will want your birds to look their best for the show, you need to know how to properly prepare and exhibit your birds.

Proper preparation begins days ahead of the show. During this time you will need to groom your bird and familiarize it with handling.

Chapter 11

STARTING A POULTRY ENTERPRISE

The demand for specialty poultry products has been steadily increasing. Some of these products include locally grown poultry meat and eggs, brown eggs, "range" eggs and meat, organic eggs and meat, gamebirds, etc. A person who is interested in starting a poultry business may find opportunities in producing a specialty poultry product.

Owning a small business or running a small enterprise can be fulfilling and very exciting. Most certainly it can be very demanding. Starting a small business like a poultry farm operation will involve many critical steps. A good business operator will:

- identify some new and exciting enterprises,
- research each enterprise and assess which enterprises best fit established goals,
- develop a business plan and
- implement all the concepts and planning that make a successful business.

A backyard or small flock owner may not have a formal plan for starting an enterprise, but he or she may at some point make a decision on whether or not to recover some of the costs of keeping your hobby animals. By talking to people in your neighborhood, you will find out which of your products can be sold. No matter what the size of your flock is, you have the potential to receive income from your birds. The following will describe some important steps in maximizing the returns from your flock.

Objectives

You must know your own goals for establishing a small poultry operation. Ask yourself:

- Does the operation need to make a profit?
- Does it have to provide a significant supplementary income?
- How much time do I have available to run this operation?
- How much money can I afford to invest?

These questions and others like them must be answered before you set up your operation. The answers will determine what kind of birds you get and the size of your operation.

Marketing

A business owner should know some of the important marketing tools. First, the term "marketing" is often used in many different ways. However, marketing is primarily a way of thinking about what the consumer wants and how to get them to buy it.

A marketer uses the four "P's" - Product, Price, Promotion, and Placement. These four tools cover the marketing activities of any business.

Product

First, what are some products that poultry can offer to the consumer. Eggs and meat come naturally to mind. Go one step further. Many gardeners and small farmers like to have manure and/or compost as their fertilizer and soil conditioner. The innovative entrepreneur can capitalize on this by selling a product that can be easily handled by the gardener.

Many people today are interested in farm-fresh, organic, or gourmet foods. Below is a list of possible products that could be marketed by the small farmer.

Eggs:	Meat:
farm-fresh	broilers
white	roasters
brown	cornish game hens
range	capons
duck or goose	turkeys
quail	pheasant or quail
fertile	ducks or geese
organic	organic
	free-range

Be imaginative. Do not let this list limit your own creativity. Remember the steps to establishing your own operation. Identify the product consumers want, and find a match with the ones in which you have an interest and resources. See if anyone else in the area is producing that product. If another farmer is selling the product, you may not want to compete with the farmer especially as you would be the "newcomer".

Costs, competition and consumers are constantly changing. Try to be flexible and able to respond to these changes. Later, you may want or need to expand or decrease your product line.

Price

Pricing a product can be very difficult. The worst competitor is one who does not know his or her costs. Do not get caught in the situation where you are charging less for your product than what it costs to produce.

Make sure all of your costs are covered by the price of your product. This includes all of your labor and the income lost from investing your money in the farm instead of an alternative investment.

Placement

Small farmers have a number of marketing placement options available to them. You may decide to sell your product directly to the end consumer to eliminate the middleman and receive all of the profits yourself. Large producers usually do not market directly to the consumer, so you need not worry about competing directly with the "big guys".

Some direct marketing options include:

- U-Pick operations
- roadside stands
- farmers' markets
- consumer cooperatives and food buying clubs
- retail, restaurant and institutions
- mail order

The direct market you choose will most likely depend on the product you sell. For instance, a person raising meat birds will not have a u-pick operation unless he or she is also selling other farm produce. Roadside stands and farmers' markets have been very successful in the Northeast where there is a large population that likes the high quality offered by these markets. They also enjoy chatting directly with the farmers. Offering a variety of products during the entire season is important for roadside stands and farmers' markets in order to establish an extensive consumer base. Many exotic or gourmet products grown for the direct markets, such as pheasant and organic products may not be available through the supermarket. Therefore, the only way to purchase them may be from the farmer.

Consumer cooperatives and food buying clubs are popular in some metropolitan and urban areas. This option may be very local and sporadic.

Retailers, restaurants and institutions are excellent large volume markets. However, these markets demand a constant supply of product and a product that is very uniform. They also probably do not pay as well as the other direct marketing outlets. Retailers and institutions may be restricted by regulations and store policies that the small producers may not be able to comply with. The small producer may also be competing directly with some of the larger producers and wholesalers.

Different products will have different marketing channels. the pheasant producer may produce birds for the local dog club or the hunting preserve. Your local 4-H office may have a great demand for fertile eggs for the Incubation and Embryology projects. You may even be able to sell all of your production to your friends, relatives and neighbors. Just remember to be creative and investigate all options.

Promotion

Promoting your farm and your product can be the most important part of your business. Remember that you need to inform, interest and persuade your consumer about your product.

Personal selling, flyers, signs and posters, displays, media ads, telephone listings, etc. can all be used to advertise yourself and your product. Attractive advertising materials will be well worth the expense. Also, make sure your farm, farm stand, farm truck, etc. are neat and clean and display the image of the product you are selling.

Use all of the four marketing "P's" as you establish your poultry operation. They will help you plan your new poultry operation so you can make an extra profit from your hobby.